# ENERGY MANAGEMENT SYSTEM (EMS) STUDY

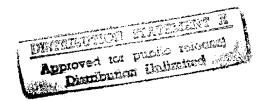
## Fort Belvoir, Virginia

Department of the Army Baltimore District U. S. Army Corps of Engineers

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### DEPARTMENT OF THE ARMY

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# Energy Management System (EMS) STUDY

Fort Belvoir, Virginia

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PROJECT NUMBER: DACA31-92-D-0061 Delivery Order # 0004

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### I. EXECUTIVE SUMMARY

### A. INTRODUCTION

General Location: Fort Belvoir is an 8,656 acre Post held fee simple by the US Army. It is located in the Commonwealth of Virginia, 14 miles south of Washington, D.C., situated primarily on a peninsula of the Potomac River. Interstate 95 and US Route 1 provide primary transportation links to Norfolk, Washington, DC, and other cities. Fort Belvoir is an Army Installation under the Command of the United States Military District of Washington (MDW).

Installation Mission: Since 1988 and its transfer to the MDW, Fort Belvoir's mission has shifted from training to service to MDW and the National Capitol Region (NCR). Within its eight mission elements are: contingency military support to the NCR, Regional Administrative Center, Regional Logistics Support, Regional Recreation Center, Classroom Center, Housing and other regional activities. The Installation is now referred to as "U.S. Army Fort Belvoir".

Ft. Belvoir has been tasked, by Executive Order 12902, with reducing the total energy consumption on the Installation by 30% of the FY1985 level by the year FY2005. The purpose of this study is to determine the most effective Energy Management Systems (EMS) to install to assist in meeting this challenge. The analysis performed was based upon five buildings of different function, occupancy and scheduling, as well as different types of mechanical systems. Three different EMS types were analyzed for their advantages and applicability to each building. The results of this study are to be used to evaluate other buildings on the Installation. The three types of systems analyzed for this study are the FM Relay (FMR), the Power Line Carrier (PLC) and the Direct Digital Control (DDC) Systems.

### **B. PURPOSE**

The purpose of this study is to compare three different types of energy management systems and determine which system would be most effective in each of a variety of different buildings. The three systems chosen for this analysis are the FM Relay (FMR), Power Line Carrier (PLC) and Direct Digital Control (DDC) systems. The analysis performed was based upon five buildings of different function, occupancy, and scheduling as well as different types of mechanical systems. The recommendations listed in this report are to be applied over the entire Installation using the criteria listed for evaluating each building. This study will develop the recommended strategies for applying energy management systems (EMS) to many of the buildings at Ft. Belvoir.

### C. BUILDING INFORMATION

The following is a list of the buildings which were analyzed for this study:

Building 200 - 26,256 square foot recreation facility

Building 219 - 32,937 square foot finance office building w/ auditorium

Building 247 - 148,067 square foot classroom building

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Building 1425 - 15,430 square foot administrative office building

Building 3136 - 11,760 square foot office building

Building energy simulations were performed for each building to determine the cost effectiveness of EMS application to each building. This information along with initial investment, maintenance and replacement costs were used to perform life cycle cost analysis for each system type being recommended.

### D. PRESENT ENERGY CONSUMPTION

The estimated present energy consumption for each building is shown in Table 1 on page I-3. This table reflects the results of the energy simulation calculations for each building as it existed at the time this study was conducted. This is true for all buildings except building 1425. This building is presently equipped with a control system which utilizes a time clock to provide time of day scheduling. In an effort to provide a comparative analysis for other buildings which are similar in size and system type, but do not have time of day scheduling, it was decided that this building will be analyzed as if it were not equipped with a time clock. For this reason the results of the analysis for building 1425 are not applicable to this building but may be used as an example when evaluating other similar buildings.

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Table 1. Estimated Present Annual Energy Consumption

	Building 200	Building 219	Building 247	Building 1425	Building 3136
Electrical Energy (kWH)	727,922	903,608	2,045,422	265,769	346,101
Electrical Energy (kBTU)	2,484,398	3,083,111	6,981,025	907,070	1,181,243
Electrical Cost (\$)	14,558	18,072	40,908	5,315	6,922
Natural Gas (Therm)	29,904	25,043	40,071		
Natural Gas (kBTU)	2,990,400	2,504,300	4,007,100		
Natural Gas Cost (\$)	18,182	15,226	24,363		
District Steam (kLBS)				254	434
District Steam (kBTU)				340,360	581,560
District Steam Cost (\$)				2,034	3,472
Total Annual Energy (kBTU)	5,474,798	5,587,411	10,988,125	1,247,564	1,762,334

### E. ENERGY CONSERVATION ANALYSIS

### **ECOs Investigated**

The following is a list of the ECOs investigated for this study:

### **Building 200**

- FMR EMS
- PLC EMS
- DDC EMS

### **Building 219**

- FMR EMS
- PLC EMS
- DDC EMS

### **ENERGY MANAGEMENT SYSTEMS (EMS) STUDY**

### FORT BELVOIR, VIRGINIA

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### **Building 247**

- FMR EMS
- PLC EMS
- DDC EMS

### Building 1425

- FMR EMS
- PLC EMS
- DDC EMS

### **Building 3136**

- FMR EMS
- PLC EMS
- DDC EMS

### **ECOs Recommended**

The following is a list of the ECOs recommended as a result of this study:

Building 200

**DDC** 

**Building 219** 

**DDC** 

Building 247

**DDC** 

Building 1425

FMR, PLC

**Building 3136** 

**FMR** 

### **ECOs Rejected**

The following is a list of ECOs which were rejected as a result of this study

### **Building 200**

- FMR
- PLC

### Building 219

- FMR
- PLC

### **Building 247**

- FMR
- PLC

**Building 1425** 

<sup>\*</sup>The recommendations made for building 1425 are for comparison of similar buildings which are not equipped with an EMS. They do not apply to building 1425.

- DDC

**Building 3136** 

- PLC
- DDC

The above listed ECO recommendations and rejections are based on the following criteria:

### Building 200, 219, and 247:

Although the FMR system results in the highest SIR and the shortest payback period, this system does not provide comprehensive EMS capability and will not save energy. As shown in the capabilities summary the FMR is capable of demand limiting only. This eliminates the FMR from consideration as a solution to the problem of reducing the total energy consumption for the entire Ft Belvoir Installation. This system should be considered, however, for use with any building which has comfort cooling using electric chillers or condensing units and is not equipped with an EMS which is capable of demand limiting. Because of the short payback period and ease of installation, the FMR can be applied in a temporary fashion to buildings which may be scheduled for EMS installation beyond 2 years in the future. FMR systems installed for this purpose can be removed, after the new EMS is installed, and then re-used for another building on the Installation. When installing the FMR system care must be taken to ensure that the relays are used to initiate a normal equipment shut-down and not to simple disconnect the incoming power to the equipment. Until the entire Installation is outfitted with an EMS that is capable of demand limiting, the FMR should be applied as described above to generate cost savings at a very attractive SIR.

The PLC provides an substantial energy savings and SIR for each individual building as shown in Table 1 on page I-3, Table 2 on page I-11 and Table 3 on page I-12. The system, as evaluated in this study, is capable of providing time of day scheduling which accounts for the majority of energy savings attributable to this type of EMS. The PLC performs this time of day scheduling at the lower cost and a higher SIR than the DDC system.

The DDC system provides the greatest energy savings potential of the three systems evaluated, as shown in Tables 1 through 3. This is important as Ft. Belvoir continues toward the goal of reducing the total energy consumption by 30% of the FY1985 levels by the year FY2005. In addition to the increased energy savings potential the DDC system offers several features which are not available on the typical PLC system. These features, which are important ingredients for a comprehensive EMS in a multiple building Installation such as, Ft. Belvoir are as follows:

On-Line monitoring and control of the building systems from a central location. The DDC system provides this capability through a network arrangement which can utilize the existing fiber optics at Ft. Belvoir or dedicated phone lines between the various buildings. The typical PLC is capable of only intermittent communications via a modem in a central computer and the controller in each building.

- Demand limiting based on an Installation-wide strategy which monitors the electric demand at the main electric sub-station providing power to all of Ft. Belvoir. The PLC is capable of demand limiting or load shedding within each individual building only. It is not capable of controlling the demand strategy for all of the buildings on the Installation. The DDC system can be equipped to continuously monitor the electric demand from a meter at the sub-station and implement the appropriate demand limiting strategy for every building connected to a central control computer. This integrated approach is necessary at Ft. Belvoir because the demand charges assessed by the electric company are based on the maximum electric demand for the entire Installation not for the individual buildings.
- Increased control system reliability and maintainability. The DDC system installation will require the replacement of many of the existing pneumatic sensors, controllers and actuators each system. For this reason the control system reliability will be significantly increased in two ways. First the new components will be replacing components which are, in many cases over twenty years old and second the sensors and controllers used in the modern DDC systems are superior in many ways to the older pneumatic components. The DDC systems also require less maintenance since all of the logic functions are performed by solid state controllers with no moving parts as compared to the old pneumatic receiver controllers and logic controllers which require periodic calibration. The economic impact attributable to this increased reliability is impossible to accurately estimate but is generally thought to be significant in most cases. The PLC system utilizes all of the existing control components and will not increase the reliability or maintainability of the control systems.

### Building 1425:

The FMR EMS should be installed on the chiller serving this building, because of the short payback period and ease of installation, the FMR can be applied When installing the FMR system care must be taken to ensure that the relays are used to initiate a normal equipment shut-down and not to simple disconnect the incoming power to the equipment. The existing control system in this building is currently equipped with the capability to provide the time-of-day scheduling which has been shown in this study to provide the largest single economic advantage of an EMS. Therefore, it is not advisable to install an EMS with time-of-day scheduling capabilities.

When analyzing similar size buildings served primarily by perimeter fan-coil units and central air cooled chilled water, and district steam heated hot water systems the PLC should be considered as an option for maximum energy savings while meeting ECIP funding criteria.

For new buildings or buildings where major mechanical renovation is planned the DDC system will should be considered for applications similar to this building. Because the DDC system would provide all of the control system and EMS capabilities the required investment in the EMS portion would be considerably less than "adding" EMS capabilities to existing systems.

**Building 3136:** 

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The age and condition of the fan coil units and the control system in this building make it a candidate for a mechanical system replacement. An example is that the fan coil units are not equipped with control valves to stop the flow of water through coil when cooling or heating is not needed. This situation causes the fan coil units to act as radiators during the heating season even after the thermostat has been satisfied and has cycled the fan off. The installation of total system EMS at the time of new equipment installation would be more cost effective.

The building is served by a packaged air cooled chiller which can be cycled to provide electrical demand savings. This building should be equipped with and FMR relay and entered into a demand limiting schedule in accordance with the strategy outlined in Example 2.1 on page II-2 of this report.

### **ECIP Projects Developed**

The following is a list of ECIP Projects developed as a result of this study:

Building 200 - DDC EMS	SIR 1.93
Building 219 - DDC EMS	SIR 2.03
Building 247 - DDC EMS	SIR 1.91
Building 1425 -FMR EMS - PLC EMS*	SIR 7.17 SIR 1.55
Building 3136 - FMR EMS	SIR 7.17

<sup>\*</sup>The PLC recommendation made for building 1425 are for comparison of similar buildings which are not equipped with an EMS. This does not apply to building 1425.

The supporting data for these projects is shown in tabular form in Section F of this summary along with the Life Cycle Cost Analysis Sheets for the ECIP Projects.

### F. EXTRAPOLATION OF RESULTS

Based on the results of this study the DDC EMS provides the greatest benefit of all the system evaluated for this study. The benefits of the DDC system can best be utilized by installing the systems with an emphasis on Installation-wide control and monitoring. This can be accomplished most effectively by packaging all of the buildings on the post which meet the criteria for EMS installation and acquiring competitive bids from qualified manufacturers and installers with experience in large multiple building Installations. It is also important to specify the requirement that all of the buildings be linked to a central control computer via a network arrangement utilizing the existing fiber optic facilities where possible and dedicated phone lines elsewhere. Another major consideration in evaluation of the manufacturers and installers is the availability and reliability of the support personnel who will be responsible for maintaining the system. It is also important that the manufacturers provide sufficient training

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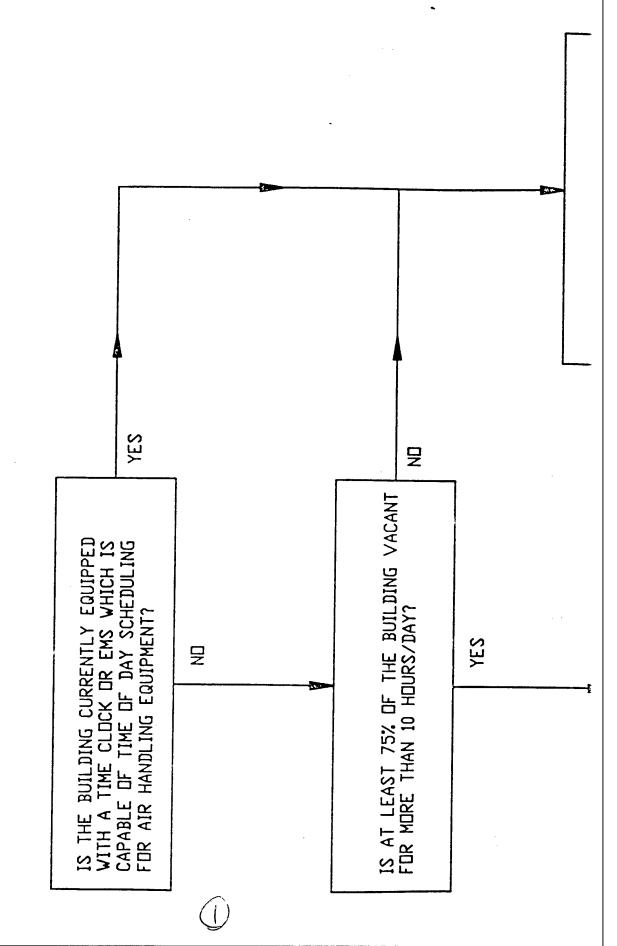
for Installation or contract personnel who are responsible for maintaining the mechanical equipment.

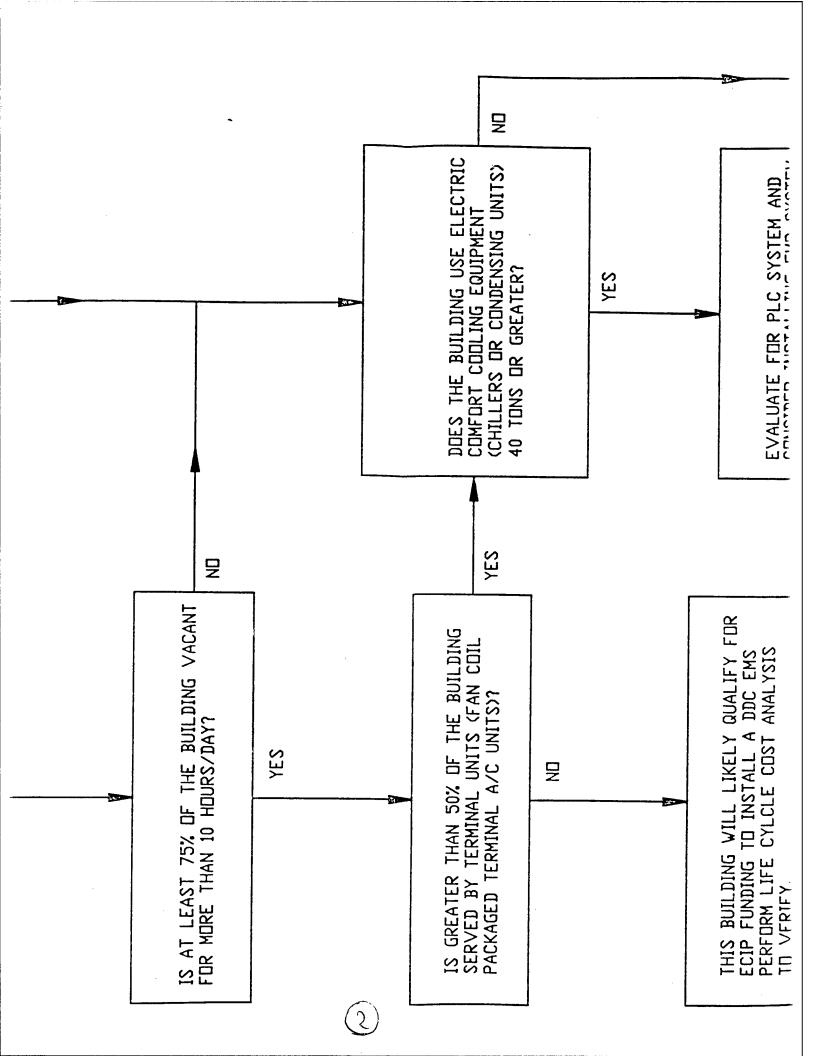
If it is not possible to perform a full scale Installation-wide implementation of the DDC systems as described above, an alternate approach can be taken. The alternate approach would be to divide the Installation into groups of buildings and acquire competitive bids for each individual group as funding becomes available. The disadvantage to utilizing this alternative approach is that the different manufacturers will likely be used for each group of buildings. This would require the installation of a central control computer for each different manufacturer or an integration package would be required to consolidate the systems into one central control computer. There are manufacturers who are currently providing integration packages which are capable of communicating with the systems of major control manufacturers. Care must be taken to specify that the control manufacturers and the integrator's systems must are compatible.

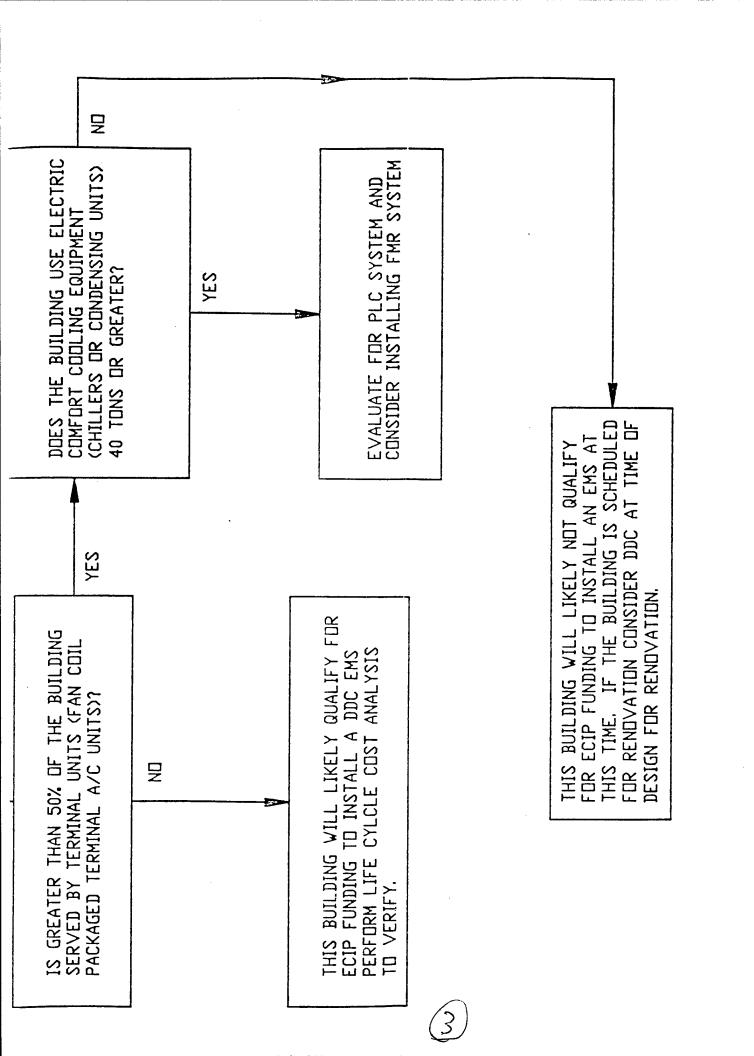
For small buildings which are served primarily by perimeter fan-coil units and central air cooled chilled water, and district steam heated hot water systems the PLC should be considered as an option for maximum energy savings while meeting ECIP funding criteria. These PLC systems should be limited in use to smaller buildings up to 20,000 sq. ft. and two stories or less with simple AC power distribution systems. The PLC systems have reportedly experienced operating problems when connected to AC power system which have a high level of electronic equipment usage. The availability of competitive vendors is limited and care should be taken when selecting systems to chose vendors with a documented history of successful installations similar to the application being considered.

The results of this study can also be extrapolated to assist energy auditors in selecting buildings for EMS implementation. The flow chart on the following page can be used as a preliminary test in selecting these buildings.

# EMS BUILDING EVALUATION FLOWCHART







Because the recommended control strategy for DDC installation involves Installation-wide systems, it may be necessary to implement these systems in buildings which do not show a payback. This is true because the goal is to maximize the energy savings for the entire Installation.

### G. TABULATION OF RESULTS

Tables 2 on page I-11, Table 3 on page I-12 and Table 4 on page I-13, list the results of the energy conservation analyses for each investigated Energy Conservation Opportunity (ECO). In addition, the EMS Capability Summary Tables compare the features of each system and their advantages and disadvantages relative to each building studied.

Life Cycle Cost Analysis Summary Sheets are included for all developed projects meeting ECIP Criteria.

TABLE 2

		TOTAL	INITIAL		SIMPLE	TOTAL	
BUILDING	ECO	SAVINGS	INVESTMENT	SIR	PAYBACK	ENERGY	REMARKS
		€9	₩.		YEAR(S)	SAVINGS KBTU	
	FMR	14,909	1,115	13.37	1	0	
Building 200	PLC	109,68	12,711	4.69	3	981,343	
	DDC	152,246	78,764	1.93	5	1,489,047	
	FMR	14,979	1,673	8.95	1	0	
Building 219	PLC	91,836	12,516	7.34	2	1,583,582	
	DDC	146,518	72,141	2.03	5	1,725,602	
	FMR	26,923	558	48.29	1	0	
Building 247	PLC	108,303	14,914	7.26	2	1,837,268	
	DDC	166,883	87,416	1.91	5	2,043,868	
	FMR	3,999	258	7.17	2	0	
Building 1425	PLC	17,893	11,518	1.55	9	297,889	*
	DDC	33,374	48,993	89.	•	312,251	*
	FMR	3,999	858	7.17	2	0	
Building 3136	PLC	17,938	10,464	1.68	9	294,780	
	DDC	32,715	48,614	79.	-	322,978	

\*As noted in Section III D, these figures are not applicable to Building 1425 because it is currently equipped with an EMS. These figures are for comparison to buildings which are similar but are not equipped with an EMS.

# TABLE 3

									_	-					<del></del>	_		_
(H) TOTAL ANNUAL COST	SAVINGS	<del>∽</del>	(B+D+F+G)	1,700	5,921	10,679	1,708	9,478	12,035	3,070	11,024	15,333	164	1,768	2,312	456	1,754	2.382
(G) ANNUAL ELECTRICAL DEMAND	SAVINGS	<b>⇔</b>		1,700	0	1,700	1,708	0	1,708	3,070	0	3,070	456	0	456	456	0	456
(F) ANNUAL DISTRICT STEAM	SAVINGS	€9	(E x \$8.0)	•					****				0	1,440	1,472	0	1,552	1,648
(E) ANNUAL DISTRICT STEAM	SAVINGS	KLBS											0	180	184	0	194	206
(D) ANNUAL NATURAL GAS	SAVINGS	89	(C x \$.608)	0	4,702	6,988	0	5,337	5,808	0	7,120	7,899	****			**		111111111111111111111111111111111111111
© ANNUAL NATURAL GAS	SAVINGS	THERM		0	7,733	11,493		8,778	9,553		11,710	12,992						
(B) ANNUAL ELECTRICAL COST	SAVINGS	89	$(A \times \$.02)$	0	1,219	1,991	0	4,141	4,519	0	3,904	4,364	0	328	384	0	202	278
(A) ANNUAL ELECTRICAL ENERGY	SAVINGS	kWh		0	956,09	99,545	0	207,057	225,961	0	195,215	218,186	0	16,374	19,208	0	10,104	13,890
ECO				FMR	PLC	DDC	FMR	PLC	DDC	FMR	PLC	DDC	FMR	PLC	DDC	FMR	PLC	DDC
BUILDING					Building 200			Building 219			Building 247			Building 1425			Building 3136	

### 18% 27% %0 28% 17% 31% %0 19% 0% 24% 25% %0 18% PERCENTAGE SAVINGS ENERGY 1,837,268 297,889 981,343 322,978 1,489,047 1,583,582 1,725,602 2,043,868 312,251 294,780 SAVINGS ENERGY ANNUAL **kBTU** 5,474,798 949,675 1,762,334 1,247,564 935,313 3,861,809 10,988,125 5,474,798 4,493,455 3,985,751 5,587,411 4,003,829 1,439,356 5,587,411 10,988,125 9,150,857 8,944,257 1,247,564 1,762,334 1,467,554 USAGE ANNUAL ENERGY **kBTU** BASELINE BASELINE BASELINE BASELINE BASELINE FMR DDC FMR DDC DDC PLC PLC FMR FMR DDC FMR DDC ECO PLC PLC PLC **Building 3136 Building 1425** Building 200 **Building 219** Building 247 BUILDING

TABLE 4

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FEATURES:	FMR	PLC	DDC
Chilled Water Reset			X
Hot Water Reset			X
Supply Air Reset			X
Enthalpy Economizer			X
Time of Day Scheduling		X	X
Night Setback			X
Demand Limiting	X		X
"On-Line" Centralized Control			X
"On-Line" Centralized Monitoring			X
Expandability		X	X
Flexibility		X	х
Maintenance Scheduling			X
Optimum Start		X	X
Occupant Control/Override		X	X
Comfort Control		X	X
ADVANTAGES:			
Increased Control System Reliability/Maintainability			X
Increased Equipment and Control System Life			X
Highest Savings - To- Investment Ratio (SIR)	X		
Provides Highest Total Energy Savings			X
Meets ECIP Funding Criteria	X	X	X
DISADVANTAGES:			
Highest Initial Cost			X
No Energy Savings	X		
Does Not Meet ECIP Funding Criteria			

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FEATURES:	FMR	PLC	DDC
Chilled Water Reset			X
Hot Water Reset			Х
Supply Air Reset			X
Enthalpy Economizer			X
Time of Day Scheduling		X	X
Night Setback			X
Demand Limiting	X		X
"On-Line" Centralized Control			X
"On-Line" Centralized Monitoring			X
Expandability		X	X
Flexibility		X	X
Maintenance Scheduling			X
Optimum Start		X	X
Occupant Control/Override		X	X
Comfort Control		X	X
ADVANTAGES:			
Increased Control System Reliability/Maintainability			X
Increased Equipment and Control System Life			X
Highest Savings - To- Investment Ratio (SIR)	X		
Provides Highest Total Energy Savings			X
Meets ECIP Funding Criteria	X	X	X
DISADVANTAGES:			
Highest Initial Cost			X
No Energy Savings	X		
Does Not Meet ECIP Funding Criteria			

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FEATURES:	FMR	PLC	DDC
Chilled Water Reset			X
Hot Water Reset			X
Supply Air Reset			Х
Enthalpy Economizer			X
Time of Day Scheduling		X	X
Night Setback			X
Demand Limiting	X		X
"On-Line" Centralized Control			X
"On-Line" Centralized Monitoring			X
Expandability		x	X
Flexibility		х	X
Maintenance Scheduling			X
Optimum Start		X	X
Occupant Control/Override		X	X
Comfort Control		X	X
ADVANTAGES:			
Increased Control System Reliability/Maintainability			X
Increased Equipment and Control System Life			X
Highest Savings - To- Investment Ratio (SIR)	X		
Provides Highest Total Energy Savings			X
Meets ECIP Funding Criteria	X	X	X
DISADVANTAGES:			
Highest Initial Cost			X
No Energy Savings	X		
Does Not Meet ECIP Criteria			

1 NOVEMBER 1995

FEATURES:	FMR	PLC	DDC
Chilled Water Reset	2.17.11.	122	X
Hot Water Reset			X
Supply Air Reset	N/A	N/A	N/A
Enthalpy Economizer	N/A	N/A	N/A
Time of Day Scheduling		X	Х
Night Setback			X
Demand Limiting	X		Х
"On-Line" Centralized Control			X
"On-Line" Centralized Monitoring			X
Expandability		X	X
Flexibility		X	X
Maintenance Scheduling			X
Optimum Start		X	X
Occupant Control/Override		X	X
Comfort Control		X	X
ADVANTAGES:			
Increased Control System Reliability/Maintainability			X
Increased Equipment and Control System Life		· · · · · · · · · · · · · · · · · · ·	X
Highest Savings - To- Investment Ratio (SIR)	X		
Provides Highest Total Energy Savings			X
Meets ECIP Funding Criteria	X	X	
DISADVANTAGES:			
Highest Initial Cost			X
No Energy Savings	X		
Does Not Meet ECIP Funding Criteria			X

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FEATURES:	FMR	PLC	DDC
Chilled Water Reset			X
Hot Water Reset			X
Supply Air Reset	N/A	N/A	N/A
Enthalpy Economizer	N/A	N/A	N/A
Time of Day Scheduling		X	X
Night Setback			X
Demand Limiting	X		X
"On-Line" Centralized Control			X
"On-Line" Centralized Monitoring			X
Expandability		X	X
Flexibility		X	X
Maintenance Scheduling			X
Optimum Start		X	X
Occupant Control/Override		X	X
Comfort Control		X	X
ADVANTAGES:			
Increased Control System Reliability/Maintainability			X
Increased Equipment and Control System Life			X
Highest Savings - To- Investment Ratio (SIR)	X		
Provides Highest Total Energy Savings			X
Meets Funding Criteria	X	X	
DISADVANTAGES:			
Highest Initial Cost			X
No Energy Savings	X		
Does Not Meet ECIP Funding Criteria			X

1 NOVEMBER 1995

	Ft. Belvoir EMS Study	FIS	CAL YEAR9		00061 Del. Order 4	
	TON NAME: <u>BUILDING 2</u>			חחדים	ECIP N	
ANALYSIS D		NOMIC LIFE: 1	<u>0</u> YEARS	PHEPA	HER: <u>EINHUHN</u>	LYAFFEE PRESCOTT
	STMENT COSTS:	-	=	<del>ሱ</del> ማ	0.640	
	JCTION COST		_		0,640	
B. SIOH C. DESIGN (	COST	<u> </u>			4,238 3,885	
				Ψ-	3,003	
	OST (1A+1B+1C) : VALUE OF EXISTII	NG EOLIIDMENT				
	ITILITY COMPANY F	·			<del></del>	
	VESTMENT (1D-1E			\$7	8,763	
a, TOTAL III	VECTALIA! (ID-IE	-11 /		Ψι	0,700	
2 ENERGY	SAVINGS (+)/COST	(-)·				
	STIR -4942-1 USED		= FACTORS	(Oct 19	994)) DISC	COUNT RATE: 3.1%
					<u> </u>	
	COST	SAVINGS	ANNU	AL\$	DISCOUNT	DISCOUNTED
ENERGY	\$ / MBTU (1)	MBTU / YR (2)	SAVIN	GS (3)	FACTOR (4)	SAVINGS (5)
A. ELEC	5.86	339.7	\$1,	991	8.82	\$17,561
B. DIST	5.97	<del></del>				added wheel and the second sec
C. RESID						
D. NG	6.08	1149.3	\$6,	988	9.86	\$68,902
G.				700		
H. DEMAND	SAVINGS	-		,700	8.4	
I. TOTAL				),679	-	\$100,896
2 NO	N ENERGY SAVING	e (.) or coet (	١,			
<u>3. IYO</u> I	N-ENERGY SAVING	3 (+) OH COST (-	<del>'}</del>			
A. ANI	NUAL RECURRING	(+/-)		\$5,560		
	COUNT FACTOR (T				- 8.49	
	COUNTED SAVING		.1)			 \$47,204

В.	NON-RECUP	RRING SAVINGS (+)	OR COST (-)			
		SAVINGS (+)	YEAR OF	DISCOUNT	DISCOUNTED	SAVINGS(+)
		COST (-) (1)	OCCUR. (2)	FACTOR(3)	COST	(-) (4)
_a.						\$0
b.						\$0
C.						\$0
d.	TOTAL	\$0				\$0
<u>C.</u>	TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2+3bD4)					\$61,637
_4	SIMPLE PAY	'BACK (1G / (2l3+3A	+ (3Bd1 / ECONO!	MIC LIFE)));	4.9	YEARS
5.	TOTAL NET DISCOUNTED SAVINGS (215+3C):				\$148,100	<u>.</u>
6:	SAVINGS TO INVESTMENT RATIO (SIR) (5/1G):				1.88	
_7	ADJUSTED INTERNAL RATE OF RETURN (AIRR):				9.82%	

1 NOVEMBER 1995

PROJE	TON: <u>Ft. Belvo</u> CCT TITLE: <u>Ft</u> ETE PORTION	. Belvoir EM	EGION NO. <u>3</u> S Study LDING 219 - DD	FISCAL	YEAR <u>95</u>	<u>;                                    </u>	Del. Order 4		
ANALYSIS	S DATE: <u>1/95</u>	ECONOM	MIC LIFE: 10	YEARS	PREPARE	R: <u>EINHORN YAF</u>	EE PRESCOTT		
<u>1.   </u>	VVESTMENT C	OSTS:							
<b>A</b> . C	A. CONSTRUCTION COST \$64,700								
В. 5	SIOH				\$3,88	32			
C. E	ESIGN COST				\$3,55	59			
D. T	OTAL COST (1	A+1B+1C)							
E. S	ALVAGE VALU	JE OF EXIS	TING						
F. F	UBLIC UTILITY	COMPAN'	/ REBATE						
G. T	OTAL INVEST	MENT (1D-1	IE-1F)		\$72,14	11			
2. E	NERGY SAVIN	GS (+)/COS	\$T(-):						
DATE OF	NISTIR -4942-1	USED FO	R DISCOUNT FA	CTORS _	(Oct 1994))	DISCOUNT	<u> 7 RATE: 3.1%</u>		
	C	OST	SAVINGS	AN	NUAL \$	DISCOUNT	DISCOUNTED		
ENERGY	\$/MB1	ʻU (1)	MBTU / YR (2)	) SA	VINGS (3)	FACTOR (4)	SAVINGS (5)		
A. ELEC		5.86	770.3		\$4,514	8.82	\$39,813		
B. DIST		5.97				·	-		
C. RESID	<del></del>		055.0		<b></b>				
D. NG		6.08	955.3	<del></del>	\$5,808	9.86	\$57,267		
G. OTHER					700	9.40	£1.4.501		
H. DEMAND SAVINGS				,708 ,028	8.49	\$14,501			
I. TOTAL					,026		\$111,581		
3 N	ION-ENERGY 9	RAVINGS (1	-) OR COST (-);						
<u> </u>	CN-ENERGY C	PAVINGO (+	<u>7 OH OOST (-) </u>	=					
A. ANNUAL RECURRING (+/-)					\$3,710				
(1) DISCOUNT FACTOR (TABLE A)						8.49			
							\$31,498		

В.	NON-RECUP	RRING SAVINGS (+)	OR COST (-)			
		SAVINGS (+)	YEAR OF	DISCOUNT	DISCOUNTED	SAVINGS(+)
		COST (-) (1)	OCCUR. (2)	FACTOR(3)	COST(-) (4)	
<u>a.</u>						\$0
b.						\$0
C.						\$0
d.	TOTAL	<b>\$0</b>				\$0
C.	TOTAL NON	ENERGY DISCOUN	TED SAVINGS (3A	A2+3bD4)		\$45,999
4.	SIMPLE PAY	BACK (1G / (213+3A	+ (3Bd1 / ECONON	MIC LIFE))):	4.6	YEARS
_5.	TOTAL NET DISCOUNTED SAVINGS (2N5+3C):				\$143,079	_
6:	SAVINGS TO INVESTMENT RATIO (SIR) (5/1G):				1.98	_
_7	ADJUSTED INTERNAL RATE OF RETURN (AIRR):				10.40%	

1 NOVEMBER 1995

PROJEC	ON: <u>Ft. Belvoir, VA</u> CT TITLE: <u>Ft. Belvo</u> TE PORTION NAME	HEGION NO. 3 ir EMS Study :: BUILDING 247 - DI	FISCAL YEAR 9		Del. Order 4	
ANALYSIS	DATE: <u>1/95</u> ECC	NOMIC LIFE: 10	YEARS PREPARE	R: <u>EINHORN YAF</u>	FEE PRESCOTT	
1. IN	VESTMENT COSTS	:	•			
A. CC	ONSTRUCTION COS	ST	\$78,4	00		
B. Sie	ОН		\$4,7	04		
C. DE	SIGN COST		\$4,3	12		
D. TO	TAL COST (1A+1B-	+1C)				
E. SALVAGE VALUE OF EXISTING						
F. PL	JBLIC UTILITY COM	PANY REBATE				
G. TO	TAL INVESTMENT	(1D-1E-1F)	\$87,4	16		
2. EN	IERGY SAVINGS (+	)/COST(-):	:			
DATE OF N	IISTIR -4942-1 USEI	FOR DISCOUNT F	ACTORS (Oct 1994))	DISCOUN	T RATE: 3.1%	
	COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
ENERGY	\$ / MBTU (1)	MBTU / YR (2		FACTOR (4)	SAVINGS (5)	
A. ELEC	5.86	744.7	\$4,364	8.82	\$38,490	
B. DIST	5.97	,				
C. RESID						
D. NG	6.08	1299.2	\$7,899	9.86	\$77,884	
G. OTHER						
H. DEMANI	SAVINGS		\$3,070	8.49	\$26,064	
I. TOTAL		2044	\$15,333		\$142,438	
_						
<u>3. NC</u>	N-ENERGY SAVING	GS (+) OR COST (-):	==			
A. AN	INUAL RECURRING	i (+/-)	\$2,300			
	SCOUNT FACTOR (		Φ2,300	8.49		
		SS/COST (3A X 3A1)	<del></del>	<u> </u>	\$19,527	

В.	NON-RECUR	RING SAVINGS (+)	OR COST (-)			
		SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED	• •
_a						\$0
_b.						\$0
C.						\$0
d.	TOTAL	\$0				\$0
<u>C.</u>	TOTAL NON		\$19,527			
4.	SIMPLE PAYBACK (1G / (2/3+3A+ (3Bd1 / ECONOMIC LIFE))):				5.0	YEARS
5.	TOTAL NET DISCOUNTED SAVINGS (215+3C):				\$161,965	
6:	SAVINGS TO INVESTMENT RATIO (SIR) (5/1G):				1.85	
<u>7.</u>	ADJUSTED INTERNAL RATE OF RETURN (AIRR):				7.65%	

PROJECT	: <u>Ft. Bewoir, VA</u> H TITLE: <u>Ft. Belvoir EM</u> PORTION NAME: <u>BU</u>	IS Study	PROJECT NO. <u>DAC</u> FISCAL YEAR <u>95</u> EMS		<u>Jel, Order 4</u>	
ANALYSIS DA	TE: <u>1/95</u> ECONO	MICLIFE: 10 Y	EARS PREPARE	R: <u>EINHORN YAF</u> F	EE PRESCOTT	
1. INVE	STMENT COSTS:					
A. CON	STRUCTION COST	· · · · · · · · · · · · · · · · · · ·	\$10,33	0		
B. SIOH			\$62	0		
C. DESI	GN COST		\$56	8		
D. TOTAL COST (1A+1B+1C)						
E. SALV	AGE VALUE OF EXIS	STING				
F. PUBL	IC UTILITY COMPAN	Y REBATE				
G. TOTA	AL INVESTMENT (1D-	1E-1F)	\$11,51	8		
2. ENE	RGY SAVINGS (+)/CO	ST(-):				
DATE OF NIS	TIR -4942-1 USED FO	R DISCOUNT FACT	ORS (Oct 1994))	DISCOUNT	RATE: 3.1%	
	COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
ENERGY	\$ / MBTU (1)	MBTU / YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
A. ELEC	5.86	55.9	\$328	8.82	\$2,893	
B. DIST	5.97		4020		Ψ2,000	
C. RESID				***************************************	•	
D. NG	6.08	242.0	<u> </u>	9.86	\$14,504	
G. OTHER			<u> </u>	<u> </u>		
H. DEMAND S	SAVINGS				\$0	
I. TOTAL		298	\$1,799		\$17,397	
	· · · · · · · · ·					
3. NON	-ENERGY SAVINGS (-	+) OR COST (-):				
A. ANN	UAL RECURRING (+/-	)	\$0			
(1) DISC	OUNT FACTOR (TAB	LE A)	<u></u>			
(2) DISC	OUNTED SAVINGS/C	OST (3A Y 3A1)			\$0	

В.	NON-RECUP	RRING SAVINGS (+)	OR COST (-)			
		SAVINGS (+)	YEAR OF	DISCOUNT	DISCOUNTED	SAVINGS(+)
		COST (-) (1)	OCCUR. (2)	FACTOR(3)	COST	(-) (4)
a. ,	,					\$0
b.						\$0
C.						\$0
d.	TOTAL	<u> </u>				\$0
C.	TOTAL NON	ENERGY DISCOUN	TED SAVINGS (3A	2+3bD4)		\$0
4.	SIMPLE PAY	BACK (1G / (213+3A	+ (3Bd1 / ECONON	/IC LIFE))):	6.4	YEARS
_5,	TOTAL NET DISCOUNTED SAVINGS (215+3C):				\$17,397	<u></u>
6:	SAVINGS TO INVESTMENT RATIO (SIR) (5/1G):				1.51	
7	ADJUSTED	ADJUSTED INTERNAL RATE OF RETURN (AIRR):				

1 NOVEMBER 1995

PROJECT TI		S Study	PROJECT NO. DAG FISCAL YEAR 95 EMS		Del. Order 4		
ANALYSIS DAT	E: 1/95 ECONON	MICLIFE: 10 YE	ARS PREPARE	R: EINHORN YAFF	EE PRESCOTT		
1. INVES	TMENT COSTS:						
A. CONS	TRUCTION COST		\$50	0			
B. SIOH			\$3	0			
C. DESIG	N COST	***************************************	\$2	8			
D. TOTAL	. COST (1A+1B+1C)						
E. SALVA	GE VALUE OF EXIS	TING					
F. PUBLIC	CUTILITY COMPAN	Y REBATE					
G. TOTAL	. INVESTMENT (1D-	1E-1F)	\$55	8			
2. ENERG	GY SAVINGS (+)/COS	ST(-):					
DATE OF NIST	R -4942-1 USED FO	R DISCOUNT FACTO	ORS (Oct 1994))	DISCOUNT	RATE: 3.1%		
	COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED		
ENERGY	\$ / MBTU (1)	MBTU / YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)		
A. ELEC	5.86	0	<b>\$0</b>	8.82	\$0		
B. DIST	5.97						
C. RESID		***************************************					
D. NG	6.08	0	\$0	9.86	\$0		
G. OTHER							
H. DEMAND SA	VINGS		\$456	8.49	\$3,871		
I. TOTAL		0	\$0		\$3,871		
3. NON-E	NERGY SAVINGS (4	-) OR COST (-):					
A. ANNU	AL RECURRING (+/-)		<u>\$0</u>				
(1) DISCO	(1) DISCOUNT FACTOR (TABLE A) 8.11						
(2) DISCO	UNTED SAVINGS/C	OST (3A X 3A1)			\$0		

ADJUSTED INTERNAL RATE OF RETURN (AIRR):

<u>22.7%</u>

В.	NON-RECUR	RING SAVINGS (+)	OR COST (-)			
		SAVINGS (+)	YEAR OF	DISCOUNT	DISCOUNTED	SAVINGS(+)
		COST (-) (1)	OCCUR. (2)	FACTOR(3)	_cos1	<u>(-) (4)</u>
<u>a.</u>						<u>\$0</u>
<u>b.</u>						<u>\$0</u>
C.						<u>\$0</u>
<u>d.</u>	TOTAL	<u>\$0</u>				\$0
<u>C.</u>	TOTAL NON	ENERGY DISCOUN	TED SAVINGS (3A	<u> </u>		<u>\$0</u>
4.	SIMPLE PAY	BACK (1G/(213+3A	1.2	YEARS		
_5,	TOTAL NET	DISCOUNTED SAVI	<u>\$3.871</u>	<del></del>		
6:	SAVINGS TO	INVESTMENT RATI	O (SIR) (5/1G):		6.94	_

### ENERGY MANAGEMENT SYSTEMS (EMS) STUDY

FORT BELVOIR, VIRGINIA

1 NOVEMBER 1995

FORT BELVOIR, VIRGINIA

1 NOVEMBER 1995

# LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

PRO	JECT TI	Ft, Beivoir, VA H 「LE: Ft, Beivoir EM ORTION NAME: BUI		_ FISCAL	YEAR 95		ECIP No.	Del. Order	<u>4</u>
ANALYS	SIS DATI	E: 1/95 ECONOM	MIC LIFE: 10	YEARS	PREPARE	R: EINE	HORN YAFE	EE PRES	COTT
1,	INVEST	MENT COSTS:							
Α.	CONST	RUCTION COST			\$50	00			
В.	SIOH			_	\$3	30			
C.	DESIG	N COST		_	\$2	28			
D.	TOTAL	COST (1A+1B+1C)		_					
Ε.	SALVA	GE VALUE OF EXIS	TING	_					
F	PUBLIC	UTILITY COMPAN	Y REBATE						
G.	TOTAL	INVESTMENT (1D-	1E-1F)	_	\$55	58			
2.	ENERG	Y SAVINGS (+)/CO	ST(-):						
DATE O	F NISTI	R -4942-1 USED FO	R DISCOUNT FAC	CTORS _	(Oct 1994))		DISCOUNT	RATE:	3.1%
		COST	SAVINGS	AN	NUAL \$	DIS	COUNT	DISCO	DUNTED
ENERG'	<u>Y</u>	\$ / MBTU (1)	MBTU / YR (2)	SA	VINGS (3)	FAC	TOR (4)	SAVIN	VGS (5)
A. ELEC	<del>`</del>	5.86	0		\$0		8.82		\$0
B. DIST		5.97						•	
C. RESI	<u>D</u>			- —				-	
D. NG		6.08	0		\$0		9.86		\$0
G. OTH					·				
H. DEMAND SAVINGS					\$456		8.49		3,871
I. TOTA	<u>L</u>		0		\$0			\$:	3,871
3.	NON-E	NERGY SAVINGS (-	+) OR COST (-):	:					
Α.	ANNUA	AL RECURRING (+/-	)		<b>\$</b> 0				
(1)		UNT FACTOR (TAB	·			8	.11		
(2) DISCOUNTED SAVINGS/COST (3A X 3A1)								\$	0

<u>B.</u>	NON-RECUR	RING SAVINGS (+)	OR COST (-)		
		SAVINGS (+)	YEAR OF	DISCOUNT	DISCOUNTED SAVINGS(+)
	···-	COST (-) (1)	OCCUR. (2)	FACTOR(3)	<u>COST(-) (4)</u>
<u>a.</u>				<u> </u>	<u>\$0</u>
<u>b.</u>					<u>\$Q</u>
<u>c.</u>					<u>\$0</u>
<u>d.</u>	TOTAL	<u>\$0</u>			<u>\$0</u>
C.	TOTAL NON	ENERGY DISCOUN	TED SAVINGS (3A	2+3bD4)	<u>\$0</u>
4	SIMPLE PAYBACK (1G / (213+3A+ (3Bd1 / ECONOMIC LIFE))):				1.2 YEARS
5.	TOTAL NET DISCOUNTED SAVINGS (2N5+3C):				<u>\$3.871</u>
6;	SAVINGS TO INVESTMENT RATIO (SIR), (5/1G):				6.94
7.	ADJUSTED INTERNAL RATE OF RETURN (AIRR):				22.7%

#### II. INTRODUCTION

#### A. PURPOSE

The purpose of this study is to compare three different types of energy management systems and determine which system would be most effective in each of a variety of different buildings. The three systems chosen for this analysis are the FM Relay (FMR), Power Line Carrier (PLC) and Direct Digital Control (DDC) systems. The analysis performed was based upon five buildings of different function, occupancy, and scheduling as well as different types of mechanical systems. The recommendations listed in this report are to be applied over the entire Installation using the criteria listed for evaluating each building. This study will develop the recommended strategies for applying energy management systems (EMS) to many of the buildings at Ft. Belvoir.

#### **B. METHODOLOGY**

The analysis portion of this study is based on field surveys which were conducted over a two month period. All five buildings were surveyed and mechanical equipment and control information was documented. In addition to surveys, operating personnel and occupants were interviewed to determine the hours of usage and occupant densities. Interviews were also conducted with personnel from the energy management department at Ft. Belvoir, who operate the existing FMR system.

Each EMS type was analyzed to determine its costs, capabilities, maintenance requirements and applicability to each building. The results of this analysis are shown in an EMS Evaluation Matrix for each building and system type.

Several energy simulations were performed for each building to estimate the energy usage under different operating scenarios. For each building, a baseline simulation was performed to estimate the energy usage under the current operating conditions, and for all buildings a second simulation was performed to estimate the energy usage with an energy management system in place. Each EMS is described in Section III and the energy analysis inputs reflect the description and points list given for each system. All building simulations were performed using the **Carrier E20-II Hourly Analysis 3.04** computer program and the following parameters:

- The physical properties such as floor area, wall and roof construction, window types and sizes, lighting density, occupancy, and equipment heat gains were taken from available construction documentation and verified by field surveys. Where construction drawings were not available, the information was assumed based on known field conditions, typical building practices, and engineering judgement.
- Outside air quantities were original design values unless these numbers were not
   available. In these cases the values were estimated based upon louver sizes, supply and return fan capacity comparisons and coil entering conditions.

- Electric rates were based on the actual electric consumption charges of \$0.01968/kWh charged by Virginia Power. Demand charges were calculated separately as described later in this section.
- All heating fuel consumption costs are based on natural gas rates from Washington Gas and district steam heating rates as established by Ft. Belvoir, where applicable.
- For hydronic two pipe change-over systems, the cooling season is May through September with the heating season being all other times of the year. This is based on estimated change-over dates provided by Ft. Belvoir.
- The weather data used in all energy calculations was from Washington, DC because this is the closest geographical city for which the Carrier program includes the necessary data. It is assumed that the 1° F average difference in the monthly mean temperature between the Washington, DC and Ft. Belvoir conditions will not have a significant impact on the outcome of these calculations.

In addition to the computerized energy simulation, several analyses were performed to estimate the magnitude of savings from the improved control accuracy and electric demand limiting capabilities of DDC control systems. These factors where evaluated as follows:

- The increased control accuracy associated with the DDC systems will result in an increased operating efficiency for each of the buildings as compared to the existing control system. This is true because the DDC system will maintain setpoints more accurately and respond to condition changes more quickly than the existing pneumatic control systems which are typically slow at performing control logic functions and lose their calibration over time. The energy simulation program is not capable of accounting for these differences in control accuracy. It was assumed that the inaccuracies of the existing pneumatic control systems will result in an additional energy usage of approximately 5% in each building. This additional energy usage was reflected by increasing the estimated energy consumption values for the Baseline, FMS and PLC conditions by 5% before entering them into the Life Cycle Cost Analysis (LCCA) program (See Appendix K for Calculations).
- The energy simulation program is not capable of estimating the potential cost savings associated with electrical demand limiting capabilities of the EMS analyzed in this study. The potential demand savings was estimated for each building based on the example shown in figure 2.1. This savings figure was then reflected in the life cycle cost analysis by entering the value as a demand charge for the Baseline and PLC conditions, which do not include demand limiting capabilities.

# Figure 2.1 Electrical Demand Limiting Strategy:

An effective strategy for demand limiting on a multi-building Installation such as Fort Belvoir is to cycle off groups of equipment during periods of high electrical demand. An example of this strategy would be to connect ten chillers to an EMS. Each chiller

would be cycled off for a period of fifteen minutes in a rotating sequence with the other chillers in the group. Utilizing this strategy, power demand could be reduced by the total kW requirement of the smallest chiller in the group. During a five hour period, any one chiller would be cycled off for no more than two fifteen minute periods. With this strategy, the demand savings attributable to any group of buildings or chillers is determined by the unit or building with the smallest electric demand which is being cycled off. For this reason groups should be selected so that the electric demand for the equipment being cycled of is approximately equal for all buildings in the group. A group of ten nominal forty ton air cooled packaged chillers with a power requirement of 55.7 kW each, when cycled in accordance with this strategy, can result in a cost savings as follows:

- 55.7 kW x \$12.54/kW demand charge/month
- = \$698.5/month x 12 months/year
- = \$8382/year.

Because nine other chillers or buildings are necessary to make this strategy feasible without out a major effect on occupant comfort, the total savings attributable to one chiller or building would be 1/10 of the total or \$838.2/year. The demand savings were reflected in the economic analysis as a demand charge for the Baseline and PLC conditions, which do not include demand limiting capabilities.

The results of the building simulations along with initial investment, maintenance costs, and demand savings were used to perform Life Cycle Cost Analysis (LCCA) for EMS implementation in each building. All LCCA were performed using **NIST Building Life** Cycle Cost (BLCC) 4.0 computer program with the following parameters:

- A 10 Year study period was used, as established by the ECIP guidelines.
- The Discount Rate is 4.0%, as defined by ECIP Guidelines for 10 Year Studies.
- The Energy cost price escalation rates are based on DOE figures for industrial applications in the State of Virginia as specified by ECIP Guidelines.

An evaluation matrix was developed to compare the relative merits of the different EMS for each building. Because the FMR system provides only demand limiting capabilities and is not a comprehensive EMS it was not entered in the matrix. The following example represents the maximum values assigned to each feature used to evaluate the EMS:

# Energy Management System Evaluation Matrix

FUNCTION	EMS
Hot Water Reset	1
Supply Air Reset	1
Chilled Water Reset	1
Enthalpy Economizer	2
Time of Day Scheduling	10
Demand Limiting (Installation Wide)	2
Centralized Control	2
Centralized Monitoring	2
Expandability	2
Flexibility	2
Maintenance Scheduling	2
Optimum Start	2
Occupant Control/Override	1
Comfort Control	2
Reliability/Maintainability	2
Effect on Equipment Life	2
Maintenance Costs	2
Savings to Investment Ration (SIR)	10
Total	48

This matrix is intended to provide a relative comparison of the different EMS features. The maximum values shown above were assigned based on an assumption of the relative importance of the features listed. Items which are result in direct energy and/or money savings were given the highest values, while items which result in indirect savings or increases in system performance were given lower values. The outcome of the matrix, as well as the results of the building simulations and life cycle cost analysis, were used to formulate the recommendations listed for each building. Each recommendation was then evaluated for ECIP compliance and the results of those evaluations are listed in Table 1 in the Executive Summary portion of this report.

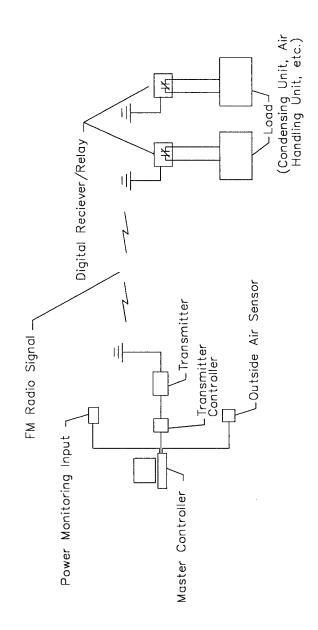
# C. EMS SYSTEM DESCRIPTIONS FM Relay (FMR) EMS Systems

The FMR system utilizes FM radio signals for communication between the centralized control location and individual equipment controllers. Each piece of equipment to be controlled is equipped with a digital receiver/relay which interlocks with the unit control system or incoming power supply. The relay can be used to interrupt the power to the piece of equipment or to interrupt the control signal, thus allowing remote start-stop control of the equipment. Figure 2.2 on page II-6 shows a schematic diagram of a typical FMR system. This system can be used effectively to provide simple automatic time scheduling and demand limiting for packaged commercial and residential HVAC equipment and lighting. A computer controls the time schedule for the operation of equipment and also cycles each piece of equipment as necessary to limit electric demand to a certain preset target value.

Priorities for load shedding are preset and the computer can select the appropriate cycling rate based on a variety of available input data or the cycling rate can be set manually by the operator. The system can be configured to receive electric demand information directly from a sub-station demand meter or from a series of contacts indicating that the demand status is above or below the target value. Cycling rates may also be controlled based on outside air temperatures, because a rise in electrical demand typically coincides with an increase in outside temperatures.

The FMR does not provide any temperature or safety control for the HVAC system, it will only enable or disable the equipment to which it is attached. The existing building control system must be maintained to perform all temperature and safety control functions. There is also no user over-ride function for this type of system.

Figure 2.2: FM Relay System Schematic



This type of system is currently used most often by utility companies to limit the electrical demand on their distribution network by cycling air conditioning systems and water heaters in residences and small commercial establishments.

A <u>Scientific Atlanta</u> FMR system is currently in operation at Fort Belvoir and is used for demand limiting in most of the housing units and approximately twenty administrative and support buildings. The installation of a new PC based master controller has greatly enhanced the system capacity and capabilities. The system is now capable of supporting 2094 different address codes and will accept contact closure, analog and/or pulse input data. The Installation is currently utilizing only a fraction of the available address codes, leaving a great deal of room for expansion of this system.

Due to the fact that the FMR operates on a one way communication principal and cannot be integrated into a total building HVAC control system it should be utilized only for on/off control of major HVAC components for demand limiting. The systems can be used very effectively to turn off HVAC equipment such as chillers and cooling tower fans for short periods of time to control electrical demand in a building or multiple building Installation. Figure 2.1 on page II-2 shows and example of an effective peak shaving strategy for a multiple building Installation such as Ft. Belvoir.

#### Power Line Carrier (PLC) EMS Systems

The PLC type control system is one in which the communication between components of the system takes place over the buildings electrical distribution wiring. This system utilizes a transmitter or encoder to generate a high frequency signal which is transmitted through the building wiring where it is received by the appropriate receiver and used to turn equipment on or off. The controller which initiates the control signals can be interfaced with a computerized energy management program which can provide time scheduling and demand limiting based on several parameters, including time of day, ambient temperatures and electric demand levels. These input parameters can only received from within the building being controlled. The typical PLC controller is not capable of communicating over a wide area network with other systems or centralized power monitoring equipment. Access is limited to "dial-up" modem communication with other controllers of similar configuration. Equipment can be controlled on an individual basis, or by electrical circuit if several units are connected to the same branch circuit or panel board. These systems can also be used to control lighting. The flexibility of this system depends greatly upon the configuration and condition of the existing building electrical system. For example, if all of the fan coil units for each floor of the building are served from a dedicated panel, that floor can be controlled as one zone by utilizing only one receiver relay.

The level of control that the PLC systems is capable of providing depends upon the power and sophistication of the controlling computer. There are variety of software packages available, each with different levels of control capability. Lower level systems provide on/off control based on manual inputs or simple time of day scheduling. Higher level systems can receive input information directly from demand

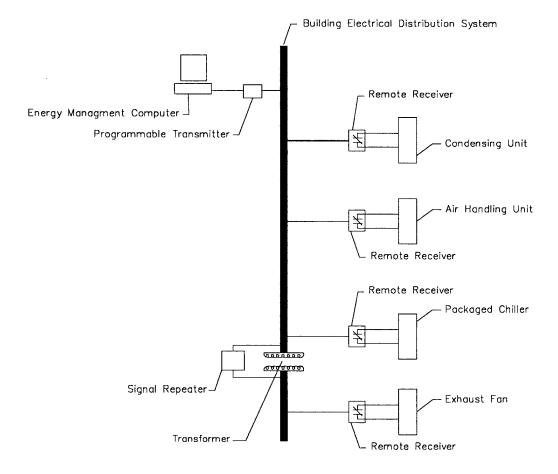
FORT BELVOIR, VIRGINIA

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metering equipment and through two way communication, monitor and track space conditions and equipment status.

Based on several factors including availability, competition and service support, it was decided for the purposes of this study that a computer controlled, on/off system would be evaluated. See Figure 2.3 on page II-9 for a typical system schematic. It should also be noted that this configuration represents the most popular usage of PLC systems in the industry today and therefore offers the best opportunity for competitive bidding. The PLC will not take the place of the existing building control system which must be maintained to provide all temperature and safety control functions.

Figure 2.3: Power Line Carrier System Schematic:



This system offers a lower level of control, monitoring, and flexibility than the DDC system.

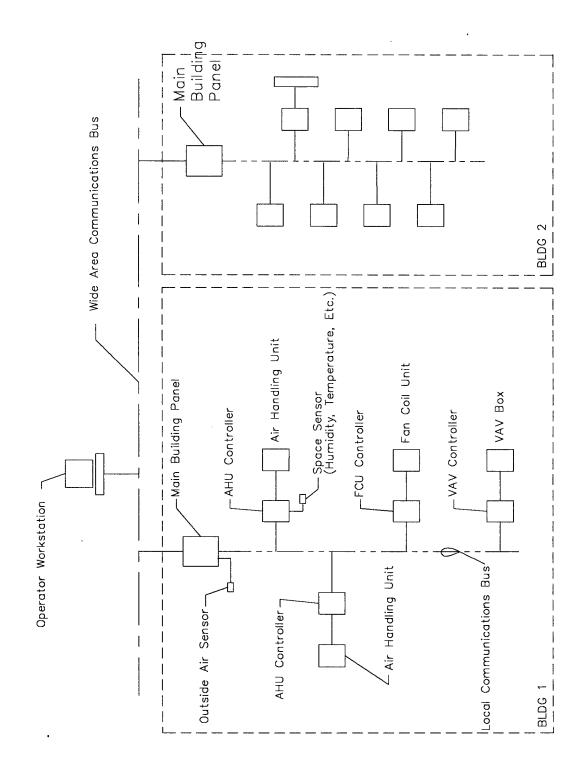
# **Direct Digital Control (DDC) EMS Systems**

A DDC system is one that typically uses a series of stand-alone controllers which are linked together in a network arrangement by use of a local communications bus. Each controller serves an individual piece of equipment such as an air handling unit, VAV box, or fan coil unit and is programmed to perform the control function independent of the other network components. The local bus provides means to collect, store, and analyze data from the controllers using network controllers or control units. See Figure 2.4 on page II-11 for a typical system schematic. These control units can provide a variety of energy management functions such as optimal start, demand limiting, water and air temperature reset as well as trend logging functions such as run time totalization and space temperature data. The network controllers can also be interlocked with other network controllers in the same building or in other buildings using a separate communications bus. This communications bus can be used to interlock several buildings at one or more sites and provide access to all of the control system components by use of an operator workstation. From the operator workstation an operator may change the setpoints and time schedules for all of the equipment connected to the system. In addition, the operator workstation can be used to store, access and output historical data which can be used for maintenance scheduling and troubleshooting of the HVAC systems. In most systems, software is available which can be used to schedule maintenance activities based on run time, elapsed time, or other operating parameters such as dirty filters.

This system offers the highest level of control, monitoring and flexibility of all systems described in this report. It is also the system most widely used in the commercial building market today. The DDC system offers the advantage of "Add-On" capabilities which allows a basic system to be continually upgraded as funding or operational requirements dictate. Because the system uses a series of twisted pair communications busses, additional points can typically be added with only a minimum of new wiring.

The building control industry along with the many major HVAC equipment manufacturers and various professional organizations are currently participating in cooperative efforts to form open protocol standards for direct digital controls in building systems. While the goal of compatibility between competing brands of control systems is not expected for the next 5 to 10 years, this effort has already resulted in a number of agreements which allow building control systems to interface with DDC components in major mechanical and electrical equipment. There are also companies which offer interface software to allow different brands of systems to be monitored and controlled with a single PC workstation.

Figure 2.4: DDC System Schematic



#### III. BUILDING ANALYSIS

#### A. BUILDING 200 - ENLISTED MEN'S SERVICE CLUB

#### **Existing System Description**

The existing mechanical system for this building consists of six constant volume, central station air handling units, one water chiller with two remote air cooled condensing units, one boiler, five pumps and several exhaust fans as well as cabinet unit heaters in each of two entrance vestibules and hot water fin-tube radiation at various areas on the perimeter of the building.

Five of the six air handling units have both hot water heating and chilled water cooling coils with three-way pneumatic control valves and are served by a remote return air fan. All five are equipped with pneumatically operated supply, return and relief dampers which are controlled by a remote mounted manually adjustable position control. The units are not equipped with economizer controls to allow for use of outside air for cooling during periods of mild weather. Two of these air handlers are multi-zone units with pneumatic zone dampers while the three are single zone units. The sixth air handling unit is heating and ventilating unit with a hot water heating coil and is ducted for 100% outside air with no return air capabilities. This unit (AHU-6) was originally designed to serve a kitchen facility which has been reduced to a small food preparation area with one small exhaust hood a small dish washing area with an exhaust hood while the remaining area has been converted to a travel office.

The chiller provides the cooling water for the entire building with a primary chilled water pump circulating the chilled water to the five cooling/heating air handling units. Each condensing unit serves a single refrigerant circuit with-in the chiller and is controlled by a thermostat which senses chilled water supply temperature. The chiller operates using refrigerant R-22.

Hot water for heating is provided by an oil fired boiler operating on a hot water reset schedule which adjusts the supply temperature based on the outside air temperature. The pumps which circulate the chilled and hot water are controlled through motor starters which are equipped with Hand-On-Automatic (HOA) switches.

#### **Analysis of EMS Options**

**DEMAND SAVINGS:** The savings attributable to a demand limiting strategy as described in Example 2.1 for this building would be calculated as follows:

2 - 60 Ton Air Cooled Chillers

1 Compressor @ 211 Amps, 200 Volts, 3 Phase 211 x 200 x  $\sqrt{3}$ 

= 73093 Volt-Amps (VA) per chiller

6 Fan Motors @ 1.5 Horsepower (10 Amps, 230 Volts, 1 Phase)

6 x 10 x 230

= 13800 VA per chiller

73093 VA + 13800 VA

= 86893 VA per chiller

86893 VA x 0.65 (Average Power Factor)

= 56480 Watts/Chiller

56480 Watts/Chiller x 2 Chillers x 1kW/1000 Watts

- = 113 kW
- = 113 kW x \$12.54/kW demand charge/month
- = \$1417/month x 12 months/year
- = \$16999/year / 10 buildings
- $= \frac{$1700}{\text{year}}$

ECO #1 FMR: The FMR system can be utilized to limit the electric demand from this building in accordance with Example 2.1. The system would consist of one receiver/relay installed on each of two condensing units (ACCU-1 and ACCU-2) to cycle the units off in accordance with the demand strategy.

The system as described above will require an initial investment of approximately \$1115 and result in an estimated savings of \$14,909 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of 13.37 and a payback period of 1 year.

ECO #2 PLC: The PLC system which was evaluated for this building includes start/stop control of the air handling units, chillers and pumps. PLC relays would be interlocked with the motor starters on supply and return fans of each air handling unit, as well as the motor starters for each pump and to the remote start/stop contacts (if present) on the air cooled condensing units of the chiller. A stand-alone transceiver would be installed to control each relay and provide communication with a remote PC workstation through a modem connection. The transceiver would be capable of providing time of day scheduling for all connected equipment based on a pre-set adjustable schedule. The following is a list of control points for this system:

#### PLC POINTS LIST

#### **Building - 200**

Point Description	Motor Starter Interlock	Unit Control Circuit Interlock	Unit Power Circuit Interlock
Air Handling Units (Typ. of 5)			
Supply Fan Start/Stop	X		
Return Fan Start/Stop	X		
Outside Air Damper Open/Close		X	
Air Handling Units (100% outside air)			
Supply Fan Start/Stop	X		
Outside Air Damper Open/Close		X	
Split Air Cooled Chiller			
Condensing Unit Enable/Disable (Typ. of 2)		X	
Chilled Water Pump Start/Stop	X		
Boiler			
Burner Enable/Disable			X
Hot Water Pump Start/Stop	X		
Standby Pump Start/Stop	X		
Radiant Heating Pump Start/Stop	X		

The system as described above will require an initial investment of approximately \$12,711 and result in an estimated savings of \$59,601 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of 4.69 and a payback period of 3 years.

ECO #3 DDC: This system would include stand-alone controllers for each air handling unit, boiler and chiller, which are capable of time of day scheduling, night setback and historical data logging. In addition the controller for the boiler will be capable of resetting the hot water supply temperature based on the outside air temperature. Each controller would be tied to a stand-alone building control panel which is capable of demand limiting and optimum start functions as well "dial-up access from a remote PC workstation or communication through an Installation-wide fiber optic system with other buildings and PC work station. The following is a list of control points for this system:

# **DDC POINTS LIST**

# **Building - 200**

Point Description	Binary Input	Analog Input	Binary Output	Analog Output
Single Zone Air Handling Units (Typ. of 3)				
Mixed Air Enthalpy		X		
Return Air Enthalpy		X		
Outside Air Enthalpy		X		
Outside Air Damper				X
Return Air Damper				X
Relief Air Damper				X
Supply Fan Start/Stop			X	
Return Fan Start/Stop	<u> </u>		X	
Supply Fan Status	X			
Return Fan Status	X			
Hot Water Valve				X
Chilled Water Valve				X
Supply Air Temperature		X		
Space Temperature		X		
Multi-zone Air Handling Units (Typ. of 2)				
Same as above				
Zone Dampers				X
Hot Deck Supply Temperature		X		
Cold Deck Supply Temperature		X		
Single Zone - 100% Outside Air (AHU-6)				
Outside Air Temperature		X		
Supply Fan Start/Stop			X	
Supply Fan Status	X			
Hot Water Valve				X
Hot Water Circulator Start/Stop			X	
Hot Water Circulator Status	X			
Discharge Air Temperature		X		
Outside Air Damper				X
Bypass Damper				X
Hot water Coil Discharge Temperature		X		
Chiller				
Chilled Water Return Temperature		X		
Chilled Water Supply Temperature	1	<u> </u>	<u> </u>	<u> </u>

Point Description	Binary Input	Analog Input	Binary Output	Analog Output
Condensing Unit Start/Stop (Typ. of 2)			X	
Condensing Unit Status (Typ. of 2)	X			
Chilled Water Pump Start/Stop			X	
Chilled Water Pump Status	X	<u></u>		
Boiler				
Burner Start/Stop			X	
Burner Status	X			
Hot Water Return Temperature		X		
Hot Water Supply Temperature		X		
Hot Water Pump Start/Stop			X	
Hot Water Pump Status	X			
Standby Pump Start/Stop			X	
Standby Pump Status	X			
Radiant Heating Pump Start/Stop			X	
Radiant Heating Pump Status	X		<u> </u>	

The system as described above will require an initial investment of approximately \$78,764 and result in an estimated savings of \$152,246 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of 1.93 and a payback period of 5 years.

The following pages include the building simulation calculation and life cycle cost analysis results for the baseline conditions as well as each ECO.

## Building Simulation Results - Baseline Condition and ECO #1

#### ANNUAL ENERGY COSTS

#### TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	<	- Annual (\$)	Costs> (\$/sqft)*	% of Total
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	0	kWh Therm 1000 lb	5739 17313 0 0 0	0.219 0.659 0.000 0.000 0.000 0.000	18.3 % 55.2 % 0.0 % 0.0 % 0.0 %
>>> HVAC Subtotal			23052	0.878	73.5 %
Electric Natural Gas Fuel Oil Propane Remote Heating	0	kWh Therm 1000 lb	8300 0 0 0	0.316 0.000 0.000 0.000 0.000	25.1 % 0.0 % 0.0 % 0.0 % 0.0 %
>>> Non-HVAC Subtotal			8300	0.316	26.5 %
>>> GRAND TOTAL	======	=======================================	31351 =======	1.194	100.0 %

<sup>\*</sup> Cost per unit floor area is based on the gross building floor area.

Gross floor area.....: 26256 sqft Conditioned floor area....: 21402 sqft

# Building Simulation Results - ECO #2

#### ANNUAL ENERGY COSTS

Building: Building 200 - PLC 08-15-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1 of 1

#### TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy		Annual (\$)	Costs> (\$/sqft)*	
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	0	kWh Therm	4596 12836 0 0 0	0.175 0.489 0.000 0.000 0.000 0.000	17.9 % 49.9 % 0.0 % 0.0 % 0.0 %
>>> HVAC Subtotal			17432	0.664	67.7 %
Electric Natural Gas Fuel Oil Propane Remote Heating	0	kWh Therm	8300 0 0 0	0.316 0.000 0.000 0.000 0.000	32.3 % 0.0 % 0.0 % 0.0 % 0.0 %
>>> Non-HVAC Subtotal			8300	0.316	32.3 %
>>> GRAND TOTAL	======	=======================================	25732	0.980	100.0 %

<sup>\*</sup> Cost per unit floor area is based on the gross building floor area.

# Building Simulation Results - ECO #3

#### ANNUAL ENERGY COSTS

#### TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	<-	Annual (\$)	Costs> (\$/sqft)*	% of Total
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	0	kWh Therm 1000 lb	4067 11192 0 0 0	0.155 0.426 0.000 0.000 0.000 0.000	17.3 % 47.5 % 0.0 % 0.0 % 0.0 %
>>> HVAC Subtotal			15259	0.581	64.8 %
Electric Natural Gas Fuel Oil Propane Remote Heating	421743 0 0 0 0	Therm	8300 0 0 0	0.316 0.000 0.000 0.000 0.000	35.2 % 0.0 % 0.0 % 0.0 % 0.0 %
>>> Non-HVAC Subtotal			8300	0.316	35.2 %
>>> GRAND TOTAL	=======================================	=======	23559	0.897	100.0 %

<sup>\*</sup> Cost per unit floor area is based on the gross building floor area.

Gross floor area.....: 26256 sqft Conditioned floor area....: 21402 sqft

#### Life Cycle Cost Analysis - ECO #1 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG200-BASE ALTERNATIVE: BLDG200-FMR

#### PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004) DISCOUNT RATE: 3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 200-BASE.LCC ALTERNATIVE LCC FILE: 200-FMR.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG200-BASE	ALTERNATIVE: BLDG200-FMR	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S): CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$1,115	-\$1,115
SUBTOTAL FUTURE COST ITEMS:	\$0	\$1,115	-\$1,115
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$72,096 \$331,719	\$72,096 \$316,810	\$0 \$14,909
SUBTOTAL	\$403,814	\$388,906	\$14,909
TOTAL P.V. LIFE-CYCLE COST	\$403,814	\$390,021	\$13,794

NET SAVINGS FROM ALTERNATIVE BLDG200-FMR COMPARED TO ALTERNATIVE BLDG200-BASE

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG200-FMR COMPARED TO ALTERNATIVE BLDG200-BASE

P.V. of non-investment savings
SIR = ----- = 13.37
Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR)

FOR ALTERNATIVE BLDG200-FMR COMPARED TO ALTERNATIVE BLDG200-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 33.62%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 1 Discounted Payback occurs in year 1

#### ENERGY SAVINGS SUMMARY

Energy	Units	Annu	al Consumption		Life-Cycle
type		Base Case	Alternative	Savings	Savings
	<b>-</b>				
Electricity	kWh	727,922	727,922	0	0
Natural Gas	Therm	29,904	29,904	0	0

#### EMISSIONS REDUCTION SUMMARY

Energy type	Annual Base Case	Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	422.8	422.8	0.0	0.0
SOx (Kg):	3,552.7	3,552.7	0.0	0.0
NOx (Kg):	1,813.6	1,813.6	0.0	0.0
Natural Gas:				
CO2 (Mg):	157.9	157.9	0.0	0.0
SOx (Kg):	0.9	0.9	0.0	0.0
NOx (Kg):	119.6	119.6	0.0	0.0
Total:				
CO2 (Mg):	580.8	580.8	0.0	0.0
SOx (Kg):	3,553.6	3,553.6	0.0	0.0
NOx (Kg):	1,933.2	1,933.2	0.0	0.0

#### ENERGY MANAGEMENT SYSTEM (EMS) STUDY

FORT BELVOIR, VIRGINIA

1 NOVEMBER 1995

#### Life Cycle Cost Analysis - ECO #2 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG200-BASE ALTERNATIVE: BLDG200-PLC

#### PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004) DISCOUNT RATE: 3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 200-BASE.LCC ALTERNATIVE LCC FILE: 200-PLC.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

INITIAL INVESTMENT ITEM(S):	BASE CASE: BLDG200-BASE	ALTERNATIVE: BLDG200-PLC	SAVINGS FROM ALT.
CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$12,711	-\$12,711
SUBTOTAL FUTURE COST ITEMS:	\$0	\$12,711	-\$12,711
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$72,096 \$331,719	\$72,096 \$272,118	\$0 \$59,601
SUBTOTAL	\$403,814	\$344,214	\$59,601
TOTAL P.V. LIFE-CYCLE COST	\$403,814	\$356,925	\$46,890

NET SAVINGS FROM ALTERNATIVE BLDG200-PLC COMPARED TO ALTERNATIVE BLDG200-BASE

Net Savings = P.V. of non-investment savings \$59,601 Increased total investment \$12,711 Net Savings: \$46,890

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR) FOR ALTERNATIVE BLDG200-PLC COMPARED TO ALTERNATIVE BLDG200-BASE

> P.V. of non-investment savings 4.69 Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR) FOR ALTERNATIVE BLDG200-PLC COMPARED TO ALTERNATIVE BLDG200-BASE (Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 20.33%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 3 Discounted Payback occurs in year 3

#### ENERGY SAVINGS SUMMARY

Energy	Units		ual Consumption		Life-Cycle
type		Base Case	Alternative	Savings	Savings
Electricity	kWh	727,922	666,966	60,956	609,560
Natural Gas	Therm	29,904	22,171	7,733	77,330

#### EMISSIONS REDUCTION SUMMARY

Energy type	Annual Base Case	Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	422.8	387.4	35.4	354.1
SOx (Kg):	3,552.7	3,255.2	297.5	1,856.4
NOx (Kg):	1,813.6	1,661.7	151.9	1,518.7
Natural Gas:				•
CO2 (Mg):	157.9	117.1	40.8	408.4
SOx (Kg):	0.9	0.7	0.2	0.0
NOx (Kg):	119.6	88.7	30.9	309.3
Total:				
CO2 (Mg):	580.8	504.5	76.2	762.5
SOx (Kg):	3,553.6	3,255.8	297.7	1,856.4
NOx (Kg):	1,933.2	1,750.4	182.8	1,828.0

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#### Life Cycle Cost Analysis - ECO #3 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG200-BASE ALTERNATIVE: BLDG200-DDC

#### PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)

DISCOUNT RATE: 3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 200-BASE.LCC ALTERNATIVE LCC FILE: 200-DDC.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

INITIAL INVESTMENT ITEM(S):	BASE CASE: BLDG200-BASE	ALTERNATIVE: BLDG200-DDC	SAVINGS FROM ALT.
CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$78,764	-\$78,764
SUBTOTAL FUTURE COST ITEMS:	\$0	\$78,764	-\$78,764
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$72,096 \$331,719	\$24,909 \$226,660	\$47,187 \$105,059
SUBTOTAL	\$403,814	\$251,569	\$152,246
TOTAL P.V. LIFE-CYCLE COST	\$403,814	\$330,333	\$73,482

NET SAVINGS FROM ALTERNATIVE BLDG200-DDC COMPARED TO ALTERNATIVE BLDG200-BASE

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG200-DDC COMPARED TO ALTERNATIVE BLDG200-BASE

P.V. of non-investment savings
SIR = ----- = 1.93
Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG200-DDC COMPARED TO ALTERNATIVE BLDG200-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 10.12%

ESTIMATED YEARS TO PAYBACK

1 NOVEMBER 1995

Simple Payback occurs in year 5 Discounted Payback occurs in year 6

#### ENERGY SAVINGS SUMMARY

Energy type	Units	Annu Base Case	al Consumptior Alternative	n Savings	Life-Cycle Savings
Electricity	kWh	727,922	628,377	99,545	995,450
Natural Gas	Therm	29,904	18,411	11,493	114,930

#### EMISSIONS REDUCTION SUMMARY

Energy type	Annual Base Case	Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	422.8	365.0	57.8	578.2
SOx (Kg):	3,552.7	3,066.8	485.8	3,031.6
NOx (Kg):	1,813.6	1,565.6	248.0	2,480.1
Natural Gas:				
CO2 (Mg):	157.9	97.2	60.7	606.9
SOx (Kg):	0.9	0.6	0.3	0.0
NOx (Kg):	119.6	73.6	46.0	459.7
Total:				
CO2 (Mg):	580.8	462.2	118.5	1,185.2
SOx (Kg):	3,553.6	3,067.4	486.2	3,031.6
NOx (Kg):	1,933.2	1,639.2	294.0	2,939.8

## Recommendations

**Energy Management System Evaluation Matrix** 

FUNCTION	PLC	DDC
Hot Water Reset	0	1
Supply Air Reset	0	1
Chilled Water Reset	0	1
Enthalpy Economizer	0	2
Time of Day Scheduling	10	10
Demand Limiting (Installation Wide)	0	2
Centralized Control	0	2
Centralized Monitoring	0	2
Expandability	1	2
Flexibility	1	2
Maintenance Scheduling	0	2
Optimum Start	1	2
Occupant Control/Override	1	1
Comfort Control	0	2
Reliability/Maintainability	1	2
Effect on Equipment Life	0	2
Maintenance Costs	0	2
Savings to Investment Ration (SIR)	10	5
Total	25	43

The evaluation matrix above is intended to provide an objective comparison of two systems with widely varying capabilities. This matrix assigns relative value to the factors which were identified as being important in evaluating an EMS. From the results of this evaluation matrix the merits of the DDC system surpass those of the PLC system for this Building. Although the savings to investment ratio of the FMS and PLC systems exceed

that of the DDC system, the over-all energy savings and total merits of the DDC system surpass those of the other two systems for this building. The DDC system offers the greatest benefit for this building with respect to total Installation wide energy savings and HVAC system operation and maintenance.

The life cycle cost analyses indicated that all three of the systems meet the ECIP criteria.

On the basis of the greatest Installation-wide energy savings and HVAC operation and maintenance this building should be considered for a DDC EMS installation as described above.

#### **B. BUILDING 219 - FINANCE OFFICE BUILDING**

#### **Existing System Description**

The mechanical system in this building consists of two air handling units, numerous fancoil units, two air cooled chillers, two pumps, two boilers, and several exhaust fans.

One air handling unit (AHU-1) which conditions the interior of the office areas of the building and provides ventilation air for the perimeter office areas is a central station type unit with a combination hot water/chilled water coil in a 2-pipe arrangement utilizing a two-way pneumatic control valve. Air handling unit (AHU-1A) serves the auditorium portion of the building and is a field built-up type unit with a supply fan, combination hot water/chilled water coil with a two-way control valve, and an electric resistance duct heater. This unit is equipped with an economizer control to utilize outside air for cooling during periods of mild weather and a humidity control to modulate the chilled water valve and electric duct heater to maintain the relative humidity level below 50%. The perimeter office portion of the building is served by 2-pipe fan coil units which are equipped with manual fan speed controls and thermostatically controlled electric two-way hot/chilled water valves.

One chiller (C-1) is a reciprocating type with two compressors and a two-circuit remote air cooled condenser. The other chiller (C-1A) is a packaged air cooled reciprocating type which is located outside of the building. This chiller serves the auditorium portion of the building. The compressors are cycled and staged to maintain a set chilled water supply temperature. Both chillers utilize refrigerant R-22.

Heating water for the building is provided by two parallel oil fired steam boilers through separate heat exchangers which serve both the auditorium and office portion of the building.

One steam condensate unit with a receiver and dual pumps provides the means for condensate return to the boilers. One chilled water/hot water pumps serve each of the two portions of the building circulating chilled water for summer cooling and hot water for winter heating.

**Analysis of EMS options** 

**DEMAND SAVINGS:** The savings attributable to a demand limiting strategy as described in Example 2.1 for this building would be calculated as follows:

#### 1 - 60 Ton Air Cooled Chiller

2 Compressors @ 55 Amps, 460 Volt, 3 Phase

 $2 \times 55 \times 460 \times \sqrt{3}$ 

= 87642 VA

2 Fan Motors @ 11.0 Amps, 460 Volt, 3 Phase

 $2 \times 11.0 \times 460 \times \sqrt{3}$ 

= 17528 VA

#### 1 - 40 Ton Air Cooled Chiller

2 Compressors @ 40 Amps, 460 Volt, 3 Phase

 $2 \times 40 \times 460 \times \sqrt{3}$ 

= 63739 VA

4 Fan Motors @ 1.8 Amps, 460 Volt, 3 Phase

 $4 \times 1.8 \times 460 \times \sqrt{3}$ 

= 5737 VA

87642 VA + 17528 VA + 63739 VA + 5737 VA

= 174646 VA

174646 VA x 0.65 (Average Power Factor) x 1 kW/1000 Watts

= 113.5 kW

113.5 kW x \$12.54/kW demand charge/month

- = \$1423/month x 12 months/year
- = \$17076/year / 10 buildings
- $= \frac{\$1708/\text{year}}{}$

This demand savings estimate applies to both the FMR (ECO #1) and DDC (ECO #3) systems for this building.

ECO #1 FMR: The FMR system can be utilized to limit the electric demand from this building in accordance with Example 2.1 to result in the savings as calculated above. The system would consist of one receiver/relay installed on each of two air cooled chillers (C-1 and C-1A) and one receiver/relay on the air cooled condenser (ACC-1) to cycle the units off in accordance with the demand strategy.

The system as described above will require an initial investment of approximately \$1,673 and result in an estimated savings of \$14,979 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of 8.95 and a payback period of 1 year.

ECO #2 PLC: The PLC system selected for this building includes a PLC relay to control each air handling unit, pump and air cooled chiller as well as a relay for each electrical branch circuit feeding the fan coil units. A stand-alone transceiver would be installed to control each relay and provide communication with a remote PC workstation through a modem connection. The transceiver would be capable of providing time of day scheduling for all connected equipment based on a pre-set adjustable schedule. The following is a control points list for this system:

#### PLC POINTS LIST

**Building - 219** 

Point Description	Motor Starter Interlock	Unit Control Circuit Interlock	Unit Power Circuit Interlock
AHU-1 A (Auditorium)			
Supply Fan Start/Stop	X		
Outside Air Damper Open/Close		X	
AHU-1 B (Finance and Accounting)			
Supply Fan Start/Stop	X		
Return Fan Start/Stop	X		
Outside Air Damper Open/Close		<u>X</u>	
Fan Coil Units (Typ. of 38)			
Fan Start/Stop	X		
Boilers (Typ. of 2)			
Burner Enable/Disable			X
Packaged Air Cooled Chiller			
Chiller Enable/Disable		X	
Split Air Cooled Chiller			
Condenser Fans Enable/Disable		X	
Compressor Enable/Disable (Typ. of 2)		X	
Dual Temperature Water Pumps (Typ. of 2)			
Pump Start/Stop	X		

The system as described above will require an initial investment of approximately \$12,516 to install and will result in an estimated savings of \$91,836 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of 7.34 and a payback period of 2 years.

ECO #3 DDC: This system includes a stand-alone controller for each air handling unit, air cooled chiller, and boiler as well as groups of 8 fan coil units. Each controller will be connected to a stand-alone building control panel through a communication bus. Each stand-alone controller will be capable of time of day scheduling, night setback and historic data logging while the building control panel is capable of providing demand limiting and optimum start for each piece of controlled equipment. In addition the controller for the boiler will be capable of resetting the hot water supply temperature based on the outside air temperature. The control panel will also allow for "dial-up access from a remote PC workstation or communication through an Installation-wide fiber optic system with other buildings and PC work station. The following is a control points list for this system:

#### **DDC POINTS LIST**

# **Building - 219**

Point Description	Binary Input	Analog Input	Binary Output	Analog Output
AHU-1 (Finance and Accounting)				
Mixed Air Enthalpy		X		
Return Air Enthalpy		X		
Outside Air Enthalpy		X		
Outside Air Damper				X
Return Air Damper				X
Relief Air Damper				X
Supply Fan Start/Stop			X	
Return Fan Start/Stop			X	
Supply Fan Status	X			
Return Fan Status	X			
Dual Temperature Valve				X
Discharge Air Temperature		X		
Space Temperature		X		

			T	
Point Description	Binary Input	Analog Input	Binary Output	Analog Output
AHU-1 A (Auditorium)				
Outside Air Enthalpy		X		
Return Air Enthalpy		X		
Mixed Air Enthalpy		X		
Outside Air Damper				X
Return Air Damper				X
Relief Air Damper				X
Supply Fan Start/Stop			X	
Supply Fan Status	X			
Dual Temperature Valve				X
Discharge Air Temperature		X		
Discharge Relative Humidity		X		
Reheat Step Control				X
Space Temperature		X		
Space Humidity		X		
Fan Coil Units (Typ. of 38)				
Fan Start/Stop			X	
Zone Temperature		X		
Boilers (Typ. of 2)				
Burner Start/Stop			X	
Burner Status	X			
Steam Discharge Pressure		X		
Condensate Return Temperature		X		
Hot Water Converter (Typ. of 2)				
Supply Steam Pressure		X		
Condensate Return Temperature		X		
Hot Water Return Temperature		X		
Hot Water Supply Temperature		X		
Steam Valve				X
Packaged Chiller			:	
Chilled Water Return Temperature		X		
Chilled Water Supply Temperature		X		
Chiller Start/Stop			X	
Chiller Status	X			

Point Description	Binary Input	Analog Input	Binary Output	Analog Output
Split Air Cooled Chiller				
Chilled Water Supply Temperature		X		
Chilled Water Return Temperature		X		
Compressor Start/Stop			X	
Compressor Status	X			
Dual Temperature Water Loop (Typ. of 2)				
Dual Temperature Pump Start/Stop			X	
Dual Temperature Status	X			
DTW Supply Temperature		X		
DTW Return Temperature		X		
DTW Changeover Valve			X	

The system as described above will require an initial investment of \$72,141 and result in an estimated savings of \$146,518 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of 2.03 and a payback period of 5 years.

The following pages include the building simulation calculation and life cycle cost analysis results for the baseline conditions as well as each ECO.

## Building Simulation Results - Baseline Condition and ECO #1

#### ANNUAL ENERGY COSTS

Building: Building 219 - Baseline 01-04-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1 of 1

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy		<	Annual (\$)	Costs> (\$/sqft)*	% o Tota	_
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	388008 23850 0 0 0	kWh Therm		7636 14499 0 0 0	0.232 0.440 0.000 0.000 0.000 0.000	23.9 45.5 0.0 0.0 0.0	88888
>>> HVAC Subtotal				22135	0.672	69.4	8
Electric Natural Gas Fuel Oil Propane Remote Heating	496200 0 0 0 0	kWh Therm	<del>-</del> -	9765 0 0 0	0.296 0.000 0.000 0.000 0.000	30.6 0.0 0.0 0.0 0.0	88
>>> Non-HVAC Subtotal				9765	0.296	30.6	- क्ट
>>> GRAND TOTAL	======	=====		31900	0.969	100.0	= 용

<sup>\*</sup> Cost per unit floor area is based on the gross building floor area.

Gross floor area.....: 32937 sqft Conditioned floor area....: 32937 sqft

## Building Simulation Results - ECO #2

#### ANNUAL ENERGY COSTS

Building: Building 219 - PLC 01-04-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1 of 1

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy		<	Annual (\$)	Costs> (\$/sqft)*	% of Total
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	190811 15490 0 0 0	kWh Therm		3755 9417 0 0 0	0.114 0.286 0.000 0.000 0.000 0.000	16.4 % 41.1 % 0.0 % 0.0 % 0.0 % 0.0 %
>>> HVAC Subtotal				13172	0.400	57.4 %
Electric Natural Gas Fuel Oil Propane Remote Heating	496200 0 0 0 0	kWh Therm		9765 0 0 0 0	0.296 0.000 0.000 0.000 0.000	42.6 % 0.0 % 0.0 % 0.0 % 0.0 %
>>> Non-HVAC Subtotal				9765	0.296	42.6 %
>>> GRAND TOTAL	======		=====	22937	 0.696 	100.0 %

<sup>\*</sup> Cost per unit floor area is based on the gross building floor area.

# Building Simulation Results - ECO #3

#### ANNUAL ENERGY COSTS

Building: Building 219 - DDC 01-04-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1 of 1

# TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy		< Annual (\$)	Costs> (\$/sqft)*	% of Total
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	181447 15490 0 0 0	kWh Therm	3571 9417 0 0 0	0.108 0.286 0.000 0.000 0.000 0.000	15.7 % 41.4 % 0.0 % 0.0 % 0.0 % 0.0 %
>>> HVAC Subtotal	<del></del>		12987	0.394	57.1 %
Electric Natural Gas Fuel Oil Propane Remote Heating	496200 0 0 0		9765 0 0 0 0	0.296 0.000 0.000 0.000 0.000	42.9 % 0.0 % 0.0 % 0.0 %
>>> Non-HVAC Subtotal ====================================		=====	9765 22753	0.296 ====================================	42.9 % ======== 100.0 %

<sup>\*</sup> Cost per unit floor area is based on the gross building floor area.

Gross floor area.....: 32937 sqft Conditioned floor area....: 32937 sqft

## Life Cycle Cost Analysis - ECO #1 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG219-BASE ALTERNATIVE: BLDG219-FMR

#### PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004) DISCOUNT RATE: 3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 219-BASE.LCC ALTERNATIVE LCC FILE: 219-FMR.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

THIRTAL THURSDAMENT THOMAS	BASE CASE: BLDG219-BASE	ALTERNATIVE: BLDG219-FMR	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S): CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$1,673	-\$1,673
SUBTOTAL FUTURE COST ITEMS:	\$0	\$1,673	-\$1,673
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$51,685 \$331,859	\$51,685 \$316,880	\$0 \$1 <b>4,</b> 979
SUBTOTAL	\$383,544	\$368,565	\$14,979
TOTAL P.V. LIFE-CYCLE COST	\$383,544	\$370,238	\$13,306

NET SAVINGS FROM ALTERNATIVE BLDG219-FMR COMPARED TO ALTERNATIVE BLDG219-BASE

Net Savings	P.V. of non-inv Increased total		\$14,979 \$1,673
		Net Savings:	\$13,306

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG219-FMR COMPARED TO ALTERNATIVE BLDG219-BASE

P.V. of non-investment savings
SIR = ----- = 8.95
Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG219-FMR COMPARED TO ALTERNATIVE BLDG219-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 28.37%

Simple Payback occurs in year 1 Discounted Payback occurs in year 2

## ENERGY SAVINGS SUMMARY

Energy type	Units	Annu Base Case	ual Consumption Alternative	n Savings	Life-Cycle Savings
Electricity	kWh	903,608	903,608	0	0
Natural Gas	Therm	25,043	25,043	0	0

Annual Base Case	Emissions Alternative	Annual Reduction	Life-Cycle Reduction
524.9	524.9	0.0	0.0
4,410.1	4,410.1	0.0	0.0
2,251.3	2,251.3	0.0	0.0
·	·		
132.3	132.3	0.0	0.0
0.8	0.8	0.0	0.0
100.2	100.2	0.0	0.0
657.1	657.1	0.0	0.0
4,410.9	4,410.9	0.0	0.0
2,351.5	2,351.5	0.0	0.0
	524.9 4,410.1 2,251.3 132.3 0.8 100.2 657.1 4,410.9	524.9 524.9 4,410.1 4,410.1 2,251.3 2,251.3 132.3 132.3 0.8 0.8 100.2 100.2 657.1 657.1 4,410.9 4,410.9	Base Case         Alternative         Reduction           524.9         524.9         0.0           4,410.1         4,410.1         0.0           2,251.3         2,251.3         0.0           132.3         132.3         0.0           0.8         0.8         0.0           100.2         100.2         0.0           657.1         657.1         0.0           4,410.9         4,410.9         0.0

## Life Cycle Cost Analysis - ECO #2 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG219-BASE ALTERNATIVE: BLDG219-PLC

#### PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004) DISCOUNT RATE: 3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 219-BASE.LCC ALTERNATIVE LCC FILE: 219-PLC.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

INITIAL INVESTMENT ITEM(S):	BASE CASE: BLDG219-BASE	ALTERNATIVE: BLDG219-PLC	SAVINGS FROM ALT.
CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$12,516	-\$12,516
SUBTOTAL FUTURE COST ITEMS:	\$0	\$12,516	-\$12,516
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$51,685 \$331,859	\$51,685 \$240,024	\$0 \$91,836
SUBTOTAL	\$383,544	\$291,709	\$91,836
TOTAL P.V. LIFE-CYCLE COST	\$383,544	\$304,225	\$79,320

NET SAVINGS FROM ALTERNATIVE BLDG219-PLC COMPARED TO ALTERNATIVE BLDG219-BASE

Net Savings = P.V. of non-investment savings \$91,836 - Increased total investment \$12,516 Net Savings: \$79,320

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG219-PLC COMPARED TO ALTERNATIVE BLDG219-BASE

P.V. of non-investment savings
SIR = ----- = 7.34
Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG219-PLC COMPARED TO ALTERNATIVE BLDG219-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 25.84%

Simple Payback occurs in year 2 Discounted Payback occurs in year 2

#### ENERGY SAVINGS SUMMARY

Energy	Units	Annu	al Consumption	n	Life-Cycle
type		Base Case	Alternative	Savings	Savings
	<del>-</del>				
Electricity	kWh	903,608	696,551	207,057	2,070,570
Natural Gas	Therm	25,043	16,265	8,778	87,780

Energy type	Annual Base Case	Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	524.9	404.6	120.3	1,202.8
SOx (Kg):	4,410.1	3,399.5	1,010.6	6,305.8
NOx (Kg):	2,251.3	1,735.4	515.9	5,158.8
Natural Gas:				
CO2 (Mg):	132.3	85.9	46.4	463.6
SOx (Kg):	0.8	0.5	0.3	0.0
NOx (Kg):	100.2	65.1	35.1	351.1
Total:				
CO2 (Mg):	657.1	490.5	166.6	1,666.3
SOx (Kg):	4,410.9	3,400.0	1,010.8	6,305.8
NOx (Kg):	2,351.5	1,800.5	551.0	5,509.9

# Life Cycle Cost Analysis - ECO #3 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG219-BASE ALTERNATIVE: BLDG219-DDC

#### PRINCIPAL STUDY PARAMETERS:

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ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004) DISCOUNT RATE: 3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 219-BASE.LCC ALTERNATIVE LCC FILE: 219-DDC.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

TNICE TABLE COMPAND TORM (C).	BASE CASE: BLDG219-BASE	ALTERNATIVE: BLDG219-DDC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S): CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$72,141	-\$72,141
SUBTOTAL FUTURE COST ITEMS:	\$0	\$72,141	-\$72,141
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$51,685 \$331,859	\$20,199 \$216,827	\$31,486 \$115,032
SUBTOTAL	\$383,544	\$237,026	\$146,518
TOTAL P.V. LIFE-CYCLE COST	\$383,544	\$309,167	\$74,377

NET SAVINGS FROM ALTERNATIVE BLDG219-DDC COMPARED TO ALTERNATIVE BLDG219-BASE

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG219-DDC COMPARED TO ALTERNATIVE BLDG219-BASE

P.V. of non-investment savings
SIR = ----- = 2.03
Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG219-DDC COMPARED TO ALTERNATIVE BLDG219-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 10.67%

Simple Payback occurs in year 5 Discounted Payback occurs in year 5

#### ENERGY SAVINGS SUMMARY

Energy	Units	Annı	ual Consumption	1	Life-Cycle
type		Base Case	Alternative	Savings	Savings
Electricity	kWh	903,608	677,647	225,961	2,259,610
Natural Gas	Therm	25,043	15,490	9,553	95,530

Energy type	Annual Base Case	Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	524.9	393.6	131.3	1,312.6
SOx (Kg):	4,410.1	3,307.3	1,102.8	6,881.6
NOx (Kg):	2,251.3	1,688.3	563.0	5,629.7
Natural Gas:				
CO2 (Mg):	132.3	81.8	50.4	504.5
SOx (Kg):	0.8	0.5	0.3	0.0
NOx (Kg):	100.2	62.0	38.2	382.1
Total:				
CO2 (Mg):	657.1	475.4	181.7	1,817.1
SOx (Kg):	4,410.9	3,307.8	1,103.1	6,881.6
NOx (Kg):	2,351.5	1,750.3	601.2	6,011.9

# Recommendations

**Energy Management System Evaluation Matrix** 

FUNCTION	PLC	DDC
Hot Water Reset	0	1
Supply Air Reset	0	1
Chilled Water Reset	0	1
Enthalpy Economizer	0	1
Time of Day Scheduling	10	10
Demand Limiting (Installation Wide)	0	2
Centralized Control	0	2
Centralized Monitoring	0	2
Expandability	1	2
Flexibility	1	2
Maintenance Scheduling	0	2
Optimum Start	1	2
Occupant Control/Override	1	1
Comfort Control	0	2
Reliability/Maintainability	1	2
Effect on Equipment Life	1	2
Maintenance Costs	1	2
Savings to Investment Ration (SIR)	10	3
Total	27	40

The evaluation matrix above is intended to provide an objective comparison of two systems with widely varying capabilities. This matrix assigns relative value to the factors which were identified as being important in evaluating an EMS. From the results of this evaluation matrix the merits of the DDC system surpass those of the PLC system for this Building. Although the savings to investment ratio of the FMS and PLC systems exceed that of the DDC system, the over-all energy savings and total merits of the DDC system surpass those of the other two systems for this building. The DDC system offers the

greatest benefit for this building with respect to total Installation wide energy savings and HVAC system operation and maintenance.

The life cycle cost analyses indicated that all three of the systems meet the ECIP criteria.

On the basis of the greatest Installation-wide energy savings and HVAC system operation and maintenance this building should be considered for a DDC EMS installation as described above.

#### C. BUILDING 247 - HUMHPREY'S HALL

# **Existing System Description**

The existing system consists of one chiller and an accompanying cooling tower, one large air handling unit and twenty small air handling units, numerous fan-coil units, two hot water boilers, nine pumps, and several exhaust fans.

The chiller is a water cooled centrifugal type which provides chilled water for the entire building and rejects its heat to an induced draft cooling tower which is located outside of the boiler room at grade level. The chiller utilizes refrigerant R-11 and should be considered for replacement or retrofit to address the CFC issue associated with this refrigerant.

The large air handling unit located in the penthouse mechanical room serves the auditorium which is located on the first and second floors of the building. This unit is a field built-up type unit with a combination hot water/chilled water coil which is piped in a two-pipe arrangement with a three-way pneumatic control valve. The unit is equipped with a pneumatically operated outside air damper which can be adjusted manually by use of a pneumatic pressure regulator to set the outside air percentage. The small air handling units are single zone, constant volume, central station type with separate hot water and chilled water coils which are piped in a 2-pipe arrangement, each having a separate electric three-way control valve and two-way isolation valve. These units are equipped with self contained direct digital controls which provide comfort control as well as time of day scheduling functions. These units serve the classroom and administrative office areas which are located in the various wings of the building.

The faculty offices and administrative support areas are served by console type fan coil units which are located on the perimeter walls and are piped in a 2-pipe arrangement. Each unit is equipped with a manual fan speed control and a thermostatically controlled two-way electric control valve. The areas served by these units have no apparent means of outside air for the occupants. This is a potential source of indoor air quality problems in this building.

Hot water for heating the building is generated by two hot water boilers which can utilize either oil or natural gas as a fuel source. According to Ft. Belvoir operating

personnel, these boilers also provide hot water for the adjacent buildings, 268, 269 and 270.

The hot water is circulated by four base-mounted centrifugal pumps with each pump controlled thru a motor starter and a HOA control.

The chilled water is circulated by two base-mounted centrifugal pumps with each pump controlled thru a motor starter and a HOA control

The condenser water is circulated by two base-mounted centrifugal pumps with each pump controlled thru a motor starter and a HOA control

# **Analysis of EMS Options**

**DEMAND SAVINGS:** The savings attributable to a demand limiting strategy as described in Example 2.1 for this building would be calculated as follows:

1 - 300 Ton Water Cooled Chiller

1 Compressor 300 Tons @ 0.68 kW/ton 300 Ton x 0.68 kW/Ton

= 204 kW

204 kW x \$12.54/kW demand charge/month

- = \$2558/month x 12 months/year
- = \$30696/year / 10 buildings
- = \$3070/year

ECO #1 FMR: The FMR system can be utilized to limit the electric demand from this building in accordance with Example 2.1. The system would consist of one receiver/relay installed on the water cooled centrifugal chiller (C-1) to cycle the unit off in accordance with the demand strategy.

The system as described above will require an initial investment of approximately \$558 and result in an estimated savings of \$26,923 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of 48.29 and a payback period of 1 year.

ECO #2 PLC: The PLC system considered for this building includes a PLC relay for the chiller, cooling tower, and each boiler as well as one relay for each electrical branch circuit powering a fan coil unit. It is unknown at this time exactly how many branch circuits feed the fan coil units, so it was assumed for pricing purposes that on average, one branch circuit feeds 4 fan coil units. A stand-alone transceiver would be installed to control each relay and provide communication with a remote PC workstation through a modem connection. The transceiver would be capable of providing time of day scheduling for all connected equipment based on a pre-set adjustable schedule. The following is a control points list for this system:

#### PLC POINTS LIST

**Building - 247** 

Point Description	Motor Starter Interlock	Unit Control Circuit Interlock	Unit Power Circuit Interlock
Auditorium Air Handling Unit			
Supply Fan Start/Stop	X		
Outside Air Damper Open/Close		X	
Fan Coil Units (Typ. of 93)		:	
Fan Start/Stop	X		
Boilers (Typ. of 2)			
Burner Enable/Disable			X
Hot Water Pump Start/Stop			
Centrifugal Chiller			
Chiller Enable/Disable		X	
Chilled Water Pump Start/Stop (Typ. of 2)	X		
Condenser Water Pump Start/Stop (Typ. of 2)	X		
Cooling Tower Fan Start/Stop	X		

The system as described above will require an initial investment of approximately \$14,914 and result in an estimated savings of \$108,303 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of 7.26 and a payback period of 2 years.

ECO #2 DDC: This system consists of one stand-alone controller for the chiller, and each boiler, and air handling unit as well as one for each 8 fan coil units. Each controller will be capable of providing time of day scheduling and night setback as well as hot water reset for the boilers and chilled water and condenser water reset for the chiller and cooling tower. A stand-alone building control panel will provide demand limiting, and optimum start control for each piece of equipment as well as serve as a communications point for all controllers in the system. The pumps for this building will be connected to the controller for the piece of equipment in which they serve. Example: The hot water heating pumps will be connected to the boiler controller while the chilled water pumps and condenser water pumps will be connected to the chiller controller. The building control panel will also allow for "dial-up" access from a remote PC workstation or communication through an Installation-wide fiber optic system with other buildings and PC work station. The following is a control points list for this system:

# **DDC POINTS LIST**

# **Building - 247**

	<del>T</del>	I	i	
Point Description	Binary Input	Analog Input	Binary Output	Analog Output
Auditorium Air Handling Unit				
Return Air Enthalpy		X		
Outside Air Enthalpy		X		
Mixed Air Enthalpy		X		
Supply Fan Start/Stop			X	
Supply Fan Status	X			
DTW Control Valve			· · · · · · · · · · · · · · · · · · ·	X
DTW Supply Temperature		X		
Outside Air Damper	1			X
Relief Damper	<u> </u>			X
Return Damper				X
Discharge Air Temperature		X		
Fan Coil Units (Typ. of 93)				
Fan Start/Stop			X	
Zone Temperature		X		
Boilers (Typ. of 2)				
Burner Start/Stop	<del> </del>		X	
Burner Status	X	<del></del>		
Hot Water Supply Temperature		X		
Hot Water Return Temperature		X		
Hot Water Pump Start/Stop			X	
Hot Water Pump Status	X		2.	
	122			
Chiller	<u> </u>			
Chilled Water Return Temperature		X		
Chilled Water Supply Temperature		X		
Chiller Start/Stop			X	
Chiller Status	X			
Chilled Water Pump Start/Stop (Typ. of 2)			X	
Chilled Water Pump Status (Typ. of 2)	X			
Condenser Water Supply Temperature	ļ	X		
Condenser Water Return Temperature		X		
Cooling Tower Fan Start/Stop	<b></b>	ļ	X	
Cooling Tower Fan Status	X			
Condenser Water Pump Start/Stop (Typ. of 2)			X	

Point Description		Binary Input	Analog Input	Binary Output	Analog Output
Condenser Water Pump Status	(Typ. of 2)	X			

The system as described above will require an initial investment of approximately \$87,416 and result in an estimated savings of \$166,883 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of 1.91 and a payback period of 5 years.

The following pages include the building simulation calculation and life cycle cost analysis results for the baseline conditions as well as each ECO.

# Building Simulation Results - Baseline Condition and ECO #1

#### ANNUAL ENERGY COSTS

Building: Building 247 - Baseline 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1 of 1

#### TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy		< Annual (\$)	Costs> (\$/sqft)*	% of Total
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	592897 38163 0 0 0	kWh Therm	11668 23199 0 0 0	0.079 0.157 0.000 0.000 0.000 0.000	18.6 % 36.9 % 0.0 % 0.0 % 0.0 % 0.0 %
>>> HVAC Subtotal			34868	0.235	55.5 %
Electric Natural Gas Fuel Oil Propane Remote Heating	1422880 0 0 0 0	kWh Therm	28002 0 0 0 0	0.189 0.000 0.000 0.000 0.000	44.5 % 0.0 % 0.0 % 0.0 % 0.0 %
>>> Non-HVAC Subtot	al		28002	0.189	44.5 %
>>> GRAND TOTAL	:=======:: :=======	======	62870 62870	0.425	100.0 %

<sup>\*</sup> Cost per unit floor area is based on the gross building floor area.

Gross floor area.....: 148067 sqft Conditioned floor area....: 143338 sqft

# Building Simulation Results - ECO #2

#### ANNUAL ENERGY COSTS

Building: Building 247 - PLC 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1 of 1

#### TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy		< Annual (\$)	Costs> (\$/sqft)*	% of Total
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	406978 27010 0 0 0	kWh Therm	8009 16419 0 0 0	0.054 0.111 0.000 0.000 0.000 0.000	15.3 % 31.3 % 0.0 % 0.0 % 0.0 % 0.0 %
>>> HVAC Subtotal			24429	0.165	46.6 %
Electric Natural Gas Fuel Oil Propane Remote Heating	1422880 0 0 0	kWh Therm	28002 0 0 0 0	0.189 0.000 0.000 0.000 0.000	53.4 % 0.0 % 0.0 % 0.0 % 0.0 %
>>> Non-HVAC Subtot	al		28002	0.189	53.4 %
>>> GRAND TOTAL	=======================================	======	52431	0.354	100.0 %

<sup>\*</sup> Cost per unit floor area is based on the gross building floor area.

Gross floor area.....: 148067 sqft Conditioned floor area....: 143338 sqft

# Building Simulation Results - ECO #3

#### ANNUAL ENERGY COSTS

Building: Building 247 - DDC 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1 of 1

#### TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy		< Annual (\$)	Costs> (\$/sqft)*	% of Total	_
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	404356 27079 0 0 0	kWh Therm	7958 16462 0 0 0	0.054 0.111 0.000 0.000 0.000 0.000	15.2 5 31.4 5 0.0 5 0.0 5 0.0 5	8 8 8
>>> HVAC Subtotal			24419	0.165	46.6	- €
Electric Natural Gas Fuel Oil Propane Remote Heating	1422880 0 0 0	kWh Therm	28002 0 0 0 0	0.189 0.000 0.000 0.000 0.000	53.4 5 0.0 5 0.0 5 0.0 5	ક ક
>>> Non-HVAC Subtot	al		28002	0.189	53.4	 용 
>>> GRAND TOTAL			52422	0.354	100.0	- १ -

<sup>\*</sup> Cost per unit floor area is based on the gross building floor area.

Gross floor area.....: 148067 sqft Conditioned floor area....: 143338 sqft

FORT BELVOIR, VIRGINIA

1 NOVEMBER 1995

#### Life Cycle Cost Analysis - ECO #1 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG247-BASE ALTERNATIVE: BLDG247-FMR

#### PRINCIPAL STUDY PARAMETERS:

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ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004) DISCOUNT RATE: 3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 247-BASE.LCC ALTERNATIVE LCC FILE: 247-FMR.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

THE THE THE PROPERTY OF THE PARTY OF	BASE CASE: BLDG247-BASE	ALTERNATIVE: BLDG247-FMR	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S): CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$558	-\$558
SUBTOTAL FUTURE COST ITEMS:	\$0	\$558	-\$558
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$125,733 \$639,123	\$125,733 \$612,199	\$0 \$26,923
SUBTOTAL	\$764,855	\$737,932	\$26,923
TOTAL P.V. LIFE-CYCLE COST	\$764,855	\$738,489	\$26,366

NET SAVINGS FROM ALTERNATIVE BLDG247-FMR COMPARED TO ALTERNATIVE BLDG247-BASE

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG247-FMR COMPARED TO ALTERNATIVE BLDG247-BASE

P.V. of non-investment savings
SIR = ----- = 48.29
Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG247-FMR COMPARED TO ALTERNATIVE BLDG247-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 51.93%

Simple Payback occurs in year 1 Discounted Payback occurs in year 1

#### ENERGY SAVINGS SUMMARY

Energy	Units	Anni	ual Consumption	n	Life-Cycle
type		Base Case	Alternative	Savings	Savings
Electricity	kWh	2,045,422	2,045,422	0	0
Natural Gas	Therm	40,071	40,071	0	0

Energy type	Annual Base Case	Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
<del>-</del>				
CO2 (Mg):	1,188.2	1,188.2	0.0	0.0
SOx (Kg):	9,982.8	9,982.8	0.0	0.0
NOx (Kg):	5,096.1	5,096.1	0.0	0.0
Natural Gas:				
CO2 (Mg):	211.6	211.6	0.0	0.0
SOx (Kg):	1.2	1.2	0.0	0.0
NOx (Kg):	160.3	160.3	0.0	0.0
Total:				
CO2 (Mg):	1,399.8	1,399.8	0.0	0.0
SOx (Kg):	9,984.0	9,984.0	0.0	0.0
NOx (Kg):	5,256.4	5,256.4	0.0	0.0
** *	•	•		

# Life Cycle Cost Analysis - ECO #2 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG247-BASE ALTERNATIVE: BLDG247-PLC

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004) DISCOUNT RATE: 3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 247-BASE.LCC ALTERNATIVE LCC FILE: 247-PLC.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

INITIAL INVESTMENT ITEM(S):	BASE CASE: BLDG247-BASE	ALTERNATIVE: BLDG247-PLC	SAVINGS FROM ALT.
CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$14,914	-\$14,914
SUBTOTAL FUTURE COST ITEMS:	\$0	\$14,914	-\$14,914
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$125,733 \$639,123	\$125,733 \$530,820	\$0 \$108,303
SUBTOTAL	\$764,855	\$656,553	\$108,303
TOTAL P.V. LIFE-CYCLE COST	\$764,855	\$671,467	\$93,389

NET SAVINGS FROM ALTERNATIVE BLDG247-PLC COMPARED TO ALTERNATIVE BLDG247-BASE

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG247-PLC COMPARED TO ALTERNATIVE BLDG247-BASE

P.V. of non-investment savings
SIR = ----- = 7.26
Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG247-PLC COMPARED TO ALTERNATIVE BLDG247-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 25.71%

Simple Payback occurs in year 2 Discounted Payback occurs in year 2

#### ENERGY SAVINGS SUMMARY

Energy	Units	Annu	al Consumption	n	Life-Cycle
type		Base Case	Alternative	Savings	Savings
		<b>-</b>			
Electricity	kWh	2,045,422	1,850,207	195,215	1,952,150
Natural Gas	Therm	40,071	28,361	11,710	117,100

Energy type	Annual Base Case	Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
-				
CO2 (Mg):	1,188.2	1,074.8	113.4	1,134.0
SOx (Kg):	9,982.8	9,030.0	952.8	5,945.2
NOx (Kg):	5,096.1	4,609.7	486.4	4,863.7
Natural Gas:		·		•
CO2 (Mg):	211.6	149.8	61.8	618.4
SOx (Kg):	1.2	0.9	0.4	0.0
NOx (Kg):	160.3	113.4	46.8	468.4
Total:				
CO2 (Mg):	1,399.8	1,224.5	175.2	1,752.4
SOx (Kg):	9,984.0	9,030.9	953.1	5,945.2
NOx (Kg):	5,256.4	4,723.2	533.2	5,332.1
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FORT BELVOIR, VIRGINIA

1 NOVEMBER 1995

# Life Cycle Cost Analysis - ECO #3 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG247-BASE ALTERNATIVE: BLDG247-DDC

#### PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004) STUDY PERIOD: DISCOUNT RATE:

3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 247-BASE.LCC ALTERNATIVE LCC FILE: 247-DDC.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

THEMTAL THREE COMPAND THEM (C).	BASE CASE: BLDG247-BASE	ALTERNATIVE: BLDG247-DDC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S): CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$87,416	-\$87,416
SUBTOTAL FUTURE COST ITEMS:	\$0	\$87,416	-\$87,416
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$125,733 \$639,123	\$106,213 \$491,759	\$19,520 \$1 <b>4</b> 7,363
SUBTOTAL	\$76 <b>4</b> ,855	\$597,972	\$166,883
TOTAL P.V. LIFE-CYCLE COST	\$764,855	\$685,388	\$79,467

NET SAVINGS FROM ALTERNATIVE BLDG247-DDC COMPARED TO ALTERNATIVE BLDG247-BASE

Net Savings = P.V. of non-investment savings \$166,883 Increased total investment \$87,416 Net Savings: \$79,467

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR) FOR ALTERNATIVE BLDG247-DDC COMPARED TO ALTERNATIVE BLDG247-BASE

> P.V. of non-investment savings SIR = -----== 1.91 Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR) FOR ALTERNATIVE BLDG247-DDC COMPARED TO ALTERNATIVE BLDG247-BASE (Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 9.99%

Simple Payback occurs in year 5 Discounted Payback occurs in year 6

#### ENERGY SAVINGS SUMMARY

Energy	Units	Annu	al Consumption		Life-Cycle
type		Base Case	Alternative	Savings	Savings
Electricity	kWh	2,045,422	1,827,236	218,186	2,181,860
Natural Gas	Therm	40,071	27,079	12,992	129,920

Energy type	Annual Base Case	Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	1,188.2	1,061.4	126.7	1,267.4
SOx (Kg):	9,982.8	8,917.9	1,064.9	6,644.8
NOx (Kg):	5,096.1	4,552.5	543.6	5,436.0
Natural Gas:				·
CO2 (Mg):	211.6	143.0	68.6	686.1
SOx (Kg):	1.2	0.8	0.4	0.0
NOx (Kg):	160.3	108.3	52.0	519.7
Total:				
CO2 (Mg):	1,399.8	1,204.4	195.4	1,953.5
SOx (Kg):	9,984.0	8,918.7	1,065.3	6,644.8
NOx (Kg):	5,256.4	4,660.8	595.6	5,955.7

# Recommendations

Energy Management System Evaluation Matrix

FUNCTION	PLC	DDC
Hot Water Reset	0	1
Supply Air Reset	0	0
Chilled Water Reset	0	1
Enthalpy Economizer	0	0
Time of Day Scheduling	10	10
Demand Limiting (Post Wide)	0	2
Centralized Control	0	2
Centralized Monitoring	0	2
Expandability	1	2
Flexibility	1	2
Maintenance Scheduling	0	2
Optimum Start	1	2
Occupant Control/Override	1	1
Comfort Control	0	2
Reliability/Maintainability	1	2
Effect on Equipment Life	1	2
Maintenance Costs	0	2
Savings to Investment Ratio (SIR)	10	3
Total	26	38

The evaluation matrix above is intended to provide an objective comparison of two systems with widely varying capabilities. This matrix assigns relative value to the factors which were identified as being important in evaluating an EMS. From the results of this evaluation matrix the merits of the DDC system surpass those of the PLC system for this Building. Although the savings to investment ratio of the FMS and PLC systems exceed that of the DDC system, the over-all energy savings and total merits of the DDC system surpass those of the other two systems for this building. The DDC system offers the

greatest benefit for this building with respect to total Installation wide energy savings and HVAC system operation and maintenance.

The life cycle cost analyses indicate that all three of the systems meet the ECIP criteria.

On the basis of the greatest Installation-wide energy savings and HVAC system operation and maintenance this building should be considered for a DDC EMS installation as described above.

#### D. BUILDING 1425 - GM SUPPORT BUILDING

# **Existing System Description**

The existing building mechanical system consists of one chiller, one combination chilled water/hot water pump, numerous console fan-coil units, and several exhaust fans.

A packaged air cooled chiller provides chilled water for the entire building. This unit has self contained controls and cycles and stages its compressors to maintain a preset chilled water supply temperature. This chiller utilizes refrigerant R-22.

The entire building is served by a console type fan coil units which are equipped with combination hot/chilled water coils and are piped in a two-pipe arrangement. Each unit has a self contained control panel with a manual fan-speed control and a thermostatically controlled two-way electric control valve. Ventilation air is provided through a wall louver at each unit and is controlled by automatic damper. The building control system de-energizes the fan coil unit during the unoccupied periods of the day unless the setback is overridden manually or by the night thermostat which then switches control back to the individual fan coil unit.

Hot water for building heating is provided through a steam to hot water convertor which utilizes a remote steam source which is controlled by two pneumatically operated steam valves. The hot water supply temperature is adjusted in accordance with a hot water reset schedule which is based on the outside air temperature.

The two-pipe dual temperature piping system contains a change-over control valve which is used to change the system from cooling to heating and back again. This valve is controlled by a manual changer-over switch located in the face of the main automatic temperature control panel in the basement mechanical room. A high limit aquastat located in the dual temperature return piping prevents the change-over valve from switching to the cooling position when the water temperature is above 90 F and an additional high limit aquastat located in the chilled water return piping prevents the chiller from being energized when the chilled water return temperature is above 90 F.

# **Analysis of EMS Options**

This building already contains an EMS which provides time of day scheduling, night setback and hot water reset. In order to provide a basis for comparison of similar buildings which are no equipped with an EMS the building was analyzed by assuming

that there was no EMS present and estimating a "No EMS" condition. This No EMS condition was then compared to proposed PLC and DDC systems to determine the applicability of such a system to buildings of similar construction and system type. This analysis resulted in the following systems:

**DEMAND SAVINGS:** The savings attributable to a demand limiting strategy as described in Example 2.1 for this building would be calculated as follows:

## 1 - 40 Ton Air Cooled Chiller

3 Compressors @ 39.4 Amps, 200 Volt, 3 Phase  $3 \times 39.4 \times 200 \times \sqrt{3}$ 

= 40946 VA

4 Fan Motors @ 4.1 Amps x 200 Volt, 3 Phase  $4 \times 4.1 \times 200 \times \sqrt{3}$ 

= 5681 VA

40946 VA + 5681 VA

- 46627 VA
- = 46627 VA x 0.65 (Average Power Factor) x 1 kW/1000 Watts
- = 30.3 kW

30.3 kW x \$12.54/kW demand charge/month

- = \$380/month x 12 months/year
- = \$4560/year / 10 buildings
- = <u>\$456/year</u>

ECO #1 FMR: The FMR system can be utilized to limit the electric demand from this building in accordance with Example 2.1. The system would consist of one receiver/relay installed on the air cooled chiller (C-1) to cycle the unit off in accordance with the demand strategy.

The system as described above will require an initial investment of approximately \$558 and result in an estimated savings of \$3,999 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of 7.17 and a payback period of 2 years.

ECO #2 PLC: The system would consist of one PLC relay for each electrical branch connection feeding a fan coil unit, it was assumed that this would result in approximately one relay for every 4 fan coil units. The air cooled chiller would also be connected to a relay. A stand-alone transceiver would be installed to control each relay and provide communication with a remote PC workstation through a modem connection. The transceiver would be capable of providing time of day scheduling for all connected

equipment based on a pre-set adjustable schedule. The following is a control points list for this system:

## PLC POINTS LIST

# **Building - 1425**

Point Description	Motor Starter Interlock	Unit Control Circuit Interlock	Unit Power Circuit Interlock
Fan Coil Units (Typ. of 52)			
Fan Start/Stop			X
Outside Air Damper Open/Close		X	
Packaged Air Cooled Chiller			
Chiller Enable/Disable		X	
Dual Temperature Water Pumps (Typ. of 2)			
Pump Start/Stop	X		

The system as described above will require an initial investment of approximately \$11,518 and result in an estimated net savings of \$17,893 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of 1.55 and a payback period of 6 years.

ECO #3 DDC: This system would consist of one stand-alone controller each for the air cooled chiller and hot water converter and one controller for each 8 fan coil units. The stand-alone controllers would provide time of day scheduling, night setback and historical data logging capabilities as well as hot water reset control for the converter. One stand-alone building control panel would provide the communications interface between each controller and demand limiting and optimum start capabilities. The building controller will also allow for "dial-up" access from a remote PC workstation or communication through an Installation-wide fiber optic system with other buildings and PC work station The following is a control points list for this building:

# **DDC POINTS LIST**

**Building - 1425** 

Point Description	Binary Input	Analog Input	Binary Output	Analog Output	
Fan Coil Units (Typ. of 52)					
Fan Start/Stop					X
Outside Air Damper					X
Chiller					
Chilled Water Supply Temperature			X		
Chilled Water Return Temperature			X		
Chiller Start/Stop				X	
Chiller Status		X			
Hot Water Convertor					
Steam Supply Pressure			X		
Hot Water Supply Temperature			X		
Hot Water Return Temperature			X		
Steam Valve (Typ.	of 2)				X
Dual Temperature Water Loop					
DTW Supply Temperature			X		
DTW Return Temperature			X		
DTW Pump Start/Stop (Typ.	of 2)			X	
DTW Pump Status (Typ.	of 2)	X			
Changeover Valve (Typ.	of 2)				X

The system as described above will require an initial investment of approximately \$48,993 and result in an estimated savings of \$33,374 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of 0.68 and there is no payback.

The following pages include the building simulation calculation and life cycle cost analysis results for the baseline conditions as well as each ECO.

# Building Simulation Results - Baseline Condition and ECO #1

#### ANNUAL ENERGY COSTS

Building: Building 1425 - NO EMS 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1 of 1

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy		<	Annual (\$)	Costs> (\$/sqft)*	% of Total
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	72273 0 0 0 0 242 0	kWh	lb	1422 0 0 0 0 1934 0	0.092 0.000 0.000 0.000 0.125 0.000	20.1 % 0.0 % 0.0 % 0.0 % 27.3 % 0.0 %
>>> HVAC Subtotal				3356	0.218	47.3 %
Electric Natural Gas Fuel Oil Propane Remote Heating	189882 0 0 0 0		lb	3737 0 0 0 0	0.242 0.000 0.000 0.000 0.000	52.7 % 0.0 % 0.0 % 0.0 % 0.0 %
>>> Non-HVAC Subtotal				3737	0.242	52.7 %
>>> GRAND TOTAL	======	====:	======	7093 	0.460	100.0 %

<sup>\*</sup> Cost per unit floor area is based on the gross building floor area.

Gross floor area....: 15430 sqft Conditioned floor area...: 13736 sqft

# Building Simulation Results - ECO #2

#### ANNUAL ENERGY COSTS

Building: Building 1425 - PLC 01-05-95 Weather: Washington (Washington TMY) HAP v3.04 Prepared by: EINHORN YAFFEE PRESCOTT Page 1 of 1

#### TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy		<	Annual (\$)	Costs> (\$/sqft)*	% of Total
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	56679 0 0 0 70	kWh 1000	lb	1115 0 0 0 0 560	0.072 0.000 0.000 0.000 0.036 0.000	20.6 % 0.0 % 0.0 % 0.0 % 10.3 % 0.0 %
>>> HVAC Subtotal				1675	0.109	31.0 %
Electric Natural Gas Fuel Oil Propane Remote Heating	189882 0 0 0 0	kWh 1000	lb	3737 0 0 0 0	0.242 0.000 0.000 0.000 0.000	69.0 % 0.0 % 0.0 % 0.0 %
>>> Non-HVAC Subtotal				3737	0.242	69.0 %
>>> GRAND TOTAL				5412	0.351	100.0 %

## FORT BELVOIR, VIRGINIA

# Building Simulation Results - ECO #3

#### ANNUAL ENERGY COSTS

Building: Building 1425 - DDC
Weather: Washington (Washington TMY)
Prepared by: EINHORN YAFFEE PRESCOTT 01-05-95 HAP v3.04 E PRESCOTT Page 1 of 1

#### TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy		<	Annual (\$)	Costs> (\$/sqft)*	% of Total
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	56679 0 0 0 70 70	kWh 1000	1b	1115 0 0 0 0 560	0.072 0.000 0.000 0.000 0.036 0.000	20.6 % 0.0 % 0.0 % 0.0 % 10.3 % 0.0 %
>>> HVAC Subtotal				1675	0.109	31.0 %
Electric Natural Gas Fuel Oil Propane Remote Heating	189882 0 0 0 0	kWh 1000	lb	3737 0 0 0 0	0.242 0.000 0.000 0.000 0.000	69.0 % 0.0 % 0.0 % 0.0 %
>>> Non-HVAC Subtotal				3737	0.242	69.0 %
>>> GRAND TOTAL	=======	=====	======	5412 ======	0.351	100.0 %

#### Life Cycle Cost Analysis - ECO #1 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG1425BASE ALTERNATIVE: BLDG1425-FMR

#### PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004) DISCOUNT RATE: 3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 1425BASE.LCC ALTERNATIVE LCC FILE: 1425-FMS.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG1425BASE	ALTERNATIVE: BLDG1425-FMR	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S): CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$558	-\$558
SUBTOTAL FUTURE COST ITEMS:	\$0	\$558	-\$558
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$41,840 \$71,752	\$41,840 \$67,753	\$0 \$3,999
SUBTOTAL	\$113,592	\$109,593	\$3,999
TOTAL P.V. LIFE-CYCLE COST	\$113,592	\$110,151	\$3,442

NET SAVINGS FROM ALTERNATIVE BLDG1425-FMR COMPARED TO ALTERNATIVE BLDG1425BASE

Net Savings = P.V. of non-investment savings \$3,999
- Increased total investment \$558
-----Net Savings: \$3,442

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG1425-FMR COMPARED TO ALTERNATIVE BLDG1425BASE

P.V. of non-investment savings
SIR = ----- = 7.17
Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG1425-FMR COMPARED TO ALTERNATIVE BLDG1425BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 25.55%

Simple Payback occurs in year 2 Discounted Payback occurs in year 2

## ENERGY SAVINGS SUMMARY

Energy type	Units	Annu Base Case	al Consumptior Alternative	n Savings	Life-Cycle Savings
	<del></del>				
Electricity	kWh	265,769	265,769	0	0
Central Steam	Pound	254,000	254,000	0	0

Energy type	Annual Base Case	Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				*
CO2 (Mg):	154.4	154.4	0.0	0.0
SOx (Kg):	1,297.1	1,297.1	0.0	0.0
NOx (Kg):	662.2	662.2	0.0	0.0
Central Steam:				
CO2 (Kg):	0.0	0.0	0.0	0.0
SOx (Kg):	0.0	0.0	0.0	0.0
NOx (Kg):	0.0	0.0	0.0	0.0
Total:				
CO2 (Mg):	154.4	154.4	0.0	0.0
SOx (Kg):	1,297.1	1,297.1	0.0	0.0
NOx (Kg):	662.2	662.2	0.0	0.0

# Life Cycle Cost Analysis - ECO #2 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG1425BASE ALTERNATIVE: BLDG1425-PLC

## PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004) DISCOUNT RATE: 3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 1425BASE.LCC ALTERNATIVE LCC FILE: 1425-PLC.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

INITIAL INVESTMENT ITEM(S): CASH REQUIREMENTS AS OF SERVICE DATE	BASE CASE: BLDG1425BASE	ALTERNATIVE: BLDG1425-PLC	SAVINGS FROM ALT.
	\$0	\$11,518	-\$11,518
SUBTOTAL FUTURE COST ITEMS:	\$0	\$11,518	-\$11,518
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$41,840 \$71,752	\$41,840 \$53,859	\$0 \$17,893
SUBTOTAL	\$113,592	\$95,699	\$17,893
TOTAL P.V. LIFE-CYCLE COST	\$113,592	\$107,217	\$6,375

NET SAVINGS FROM ALTERNATIVE BLDG1425-PLC COMPARED TO ALTERNATIVE BLDG1425BASE

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG1425-PLC COMPARED TO ALTERNATIVE BLDG1425BASE

P.V. of non-investment savings
SIR = ----- = 1.55
Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG1425-PLC COMPARED TO ALTERNATIVE BLDG1425BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 7.74%

# ENERGY MANAGEMENT SYSTEM (EMS) STUDY FORT BELVOIR, VIRGINIA

1 NOVEMBER 1995

Simple Payback occurs in year 6 Discounted Payback occurs in year 7

## ENERGY SAVINGS SUMMARY

Energy type	Units	Annı Base Case	ual Consumption Alternative	n Savings	Life-Cycle Savings
Electricity Central Steam	kWh	265,769	249,395	16,374	163,740
Central Steam	Pound	254,000	73,500	180,500	1,805,000

Energy type	Annual Base Case	Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	154.4	144.9	9.5	95.1
SOx (Kg):	1,297.1	1,217.2	79.9	498.7
NOx (Kg):	662.2	621.4	40.8	408.0
Central Steam:				
CO2 (Kg):	0.0	0.0	0.0	0.0
SOx (Kg):	0.0	0.0	0.0	0.0
NOx (Kg):	0.0	0.0	0.0	0.0
Total:				
CO2 (Mg):	154.4	144.9	9.5	95.1
SOx (Kg):	1,297.1	1,217.2	79.9	498.7
NOx (Kg):	662.2	621.4	40.8	408.0

# Life Cycle Cost Analysis - ECO #3 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG1425BASE ALTERNATIVE: BLDG1425-DDC

#### PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004) DISCOUNT RATE: 3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 1425BASE.LCC ALTERNATIVE LCC FILE: 1425-DDC.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

THIRTAL THREE COMMINION TO THE WAY CO.	BASE CASE: BLDG1425BASE	ALTERNATIVE: BLDG1425-DDC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S): CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$48,993	-\$48,993
SUBTOTAL FUTURE COST ITEMS:	\$0	\$48,993	-\$48,993
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$41,840 \$71,752	\$31,1 <b>47</b> \$ <b>4</b> 9,072	\$10,693 \$22,681
SUBTOTAL	\$113,592	\$80,218	\$33,374
TOTAL P.V. LIFE-CYCLE COST	\$113,592	\$129,211	-\$15,619

NET SAVINGS FROM ALTERNATIVE BLDG1425-DDC COMPARED TO ALTERNATIVE BLDG1425BASE

Net Savings = P.V. of non-investment savings \$33,374 Increased total investment \$48,993 Net Savings: -\$15,619

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR) FOR ALTERNATIVE BLDG1425-DDC COMPARED TO ALTERNATIVE BLDG1425BASE

> P.V. of non-investment savings SIR = -----== 0.68 Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR) FOR ALTERNATIVE BLDG1425-DDC COMPARED TO ALTERNATIVE BLDG1425BASE (Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = -0.78%

Simple Payback never reached during study period Discounted Payback never reached during study period

## ENERGY SAVINGS SUMMARY

Energy type	Units	Annu Base Case	al Consumptior Alternative	n Savings	Life-Cycle Savings
Electricity	kWh	265,769	246,561	19,208	192,080
Central Steam	Pound	254,000	70,000	184,000	1,840,000

Annual Base Case	Emissions Alternative	Annual Reduction	Life-Cycle Reduction
154.4	143.2	11.2	111.6
1,297.1	1,203.4	93.7	585.0
662.2	614.3	47.9	478.6
0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0
154.4	143.2	11.2	111.6
1,297.1	1,203.4	93.7	585.0
662.2	614.3	47.9	478.6
	Base Case 154.4 1,297.1 662.2 0.0 0.0 0.0 154.4 1,297.1	154.4 143.2 1,297.1 1,203.4 662.2 614.3 0.0 0.0 0.0 0.0 0.0 0.0 154.4 143.2 1,297.1 1,203.4	Base Case Alternative Reduction  154.4 143.2 11.2 1,297.1 1,203.4 93.7 662.2 614.3 47.9  0.0 0.0 0.0 0.0 0.0 0.0 0.0 154.4 143.2 11.2 1,297.1 1,203.4 93.7

## Recommendations

Please note that these recommendations for ECO implementation are not applicable to building 1425, only to buildings with similar systems which do not have an EMS.

**Energy Management System Evaluation Matrix** 

<u>FUNCTION</u>	PLC	DDC
Hot Water Reset	0	1
Supply Air Reset		
Chilled Water Reset	0	1
Enthalpy Economizer		
Time of Day Scheduling	10	10
Demand Limiting (Installation Wide)	0	2
Centralized Control	0	2
Centralized Monitoring	0	2
Expandability	11	2
Flexibility	1	1
Maintenance Scheduling	0	2
Optimum Start	1	1
Occupant Control/Override	1	1
Comfort Control	0	2
Reliability/Maintainability	1	2
Effect on Equipment Life	1	2
Maintenance Costs	1	1
Savings to Investment Ratio (SIR)	10	0
Total	27	32

The evaluation matrix above is intended to provide an objective comparison of two systems with widely varying capabilities. This matrix assigns relative value to the factors which were identified as being important in evaluating an EMS. From the results of this

evaluation matrix the merits of the DDC system surpass those of the PLC system for this Building. The DDC system offers the greatest benefit for this building with respect to total Installation wide energy savings and HVAC system operation and maintenance. This system; however, does not provide a pay-back with-in the life of this study and does not qualify for funding under the current ECIP criteria.

The life cycle cost analyses indicated that the FMR and PLC systems meet the ECIP criteria.

The FMR system should be installed to cycle the chiller in accordance with the demand limiting strategy described in Example 2.1 of this study. The PLC system should be considered becuase it provides significant energy savings potential and qualifies for funding under the ECIP criteria. If there are any future renovations planned for this building that involve major mechanical system rework the DDC system will be the best alternative if installed at the time of renovation.

#### E. BUILDING 3136 - DAAF OPERATIONS BUILDING

#### **Existing System Description**

The existing building mechanical system consists of one chiller, one combination chilled water/hot water pump, numerous console fan-coil units, and several exhaust fans.

A packaged air cooled chiller provides chilled water for the entire building. This unit has self contained controls and cycles and stages its compressors to maintain a preset chilled water supply temperature. This chiller utilizes refrigerant R-22.

The entire building is served by a console type fan coil units which are equipped with combination hot/chilled water coils and are piped in a two-pipe arrangement. Each unit has a thermostat that cycles the fan on a call for heating or cooling. Ventilation air is provided through a wall louver at each unit and is controlled by a manual damper. These units are not equipped with control valve to regulate or stop the flow of water through the coils. During the heating season these units tend to act like radiators when ever there is hot water flowing in the building system. This can be a major source of discomfort and energy consumption because the rooms become overheated and as observed during our site visit the occupants are forced to open the windows to offset the "run away" heat. It was also noted during the site visit that the manual ventilation dampers in several of the fan coil units where completely closed or in-operable. Although it is beyond the scope of this study it should be noted that the age and poor condition of these fan coil units make them good candidates for replacement.

Hot water for building heating is provided through a steam to hot water convertor which utilizes a remote steam source which is controlled a pneumatically operated steam valve.

The two-pipe dual temperature piping system contains two change-over control valve which are used to change the system from cooling to heating and back again. This valve is controlled by a manual changer-over switch located on the wall of the basement mechanical room. There are no apparent safety controls on this change-over function

which would prevent hot water from being circulated through the packaged chiller, a situation which could cause damage to the chiller and possible discharge of refrigerant into the atmosphere.

## **Analysis of EMS Options**

**DEMAND SAVINGS:** The savings attributable to a demand limiting strategy as described in Example 2.1 for this building would be calculated as follows:

#### 1 - 40 Ton Air Cooled Chiller

3 Compressors @ 39.4 Amps, 200 Volt, 3 Phase  $3 \times 39.4 \times 200 \times \sqrt{3}$ 

= 40946 VA

4 Fan Motors @ 4.1 Amps x 200 Volt, 3 Phase  $4 \times 4.1 \times 200 \times \sqrt{3}$ 

= 5681 VA

40946 VA + 5681 VA

- = 46627 VA
- = 46627 VA x 0.65 (Average Power Factor) x 1 kW/1000 Watts
- = 30.3 kW

30.3 kW x \$12.54/kW demand charge/month

- = \$380/month x 12 months/year
- = \$4560/year / 10 buildings
- = <u>\$456/year</u>

ECO #1 FMR: The FMR system can be utilized to limit the electric demand from this building in accordance with Example 2.1. The system would consist of one receiver/relay installed on the air cooled chiller (C-1) to cycle the units off in accordance with the demand strategy.

The system as described above will require an initial investment of approximately \$558 and result in an estimated savings of \$3,999 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of 7.17 and a payback period of 2 years.

ECO #2 PLC: The system would consist of one PLC relay for each electrical branch connection feeding a fan coil unit, it was assumed that this would result in approximately one relay for every 4 fan coil units. The air cooled chiller would also be connected to a relay. A stand-alone transceiver would be installed to control each relay and provide communication with a remote PC workstation through a modern connection. The transceiver would be capable of providing time of day scheduling for all connected equipment based on a pre-set adjustable schedule. The following is a control points list for this system:

#### PLC POINTS LIST

**Building - 3136** 

Point Description	Motor Starter Interlock	Unit Control Circuit Interlock	Unit Power Circuit Interlock
Fan Coil Units (Typ. of 47)			
Fan Start/Stop			X
Packaged Air Cooled Chiller			
Chiller Enable/Disable		X	
Dual Temperature Water Pumps			
Pump Start/Stop	X		

The system as described above will require an initial investment of approximately \$10,646 and result in an estimated savings of \$17,738 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ratio (SIR) of 1.68 and a payback period of 6 years.

ECO #3 DDC: This system would consist of one stand-alone controller each for the air cooled chiller and hot water converter and one controller for each 8 fan coil units. The stand-alone controllers would provide time of day scheduling, night setback and historical data logging capabilities as well as hot water reset control for the converter. One stand-alone building control panel would provide the communications interface between each controller and demand limiting and optimum start capabilities. The controller will also allow for "dial-up" access from a remote PC workstation or communication through an Installation-wide fiber optic system with other buildings and PC work station The following is a control points list for this system:

### **DDC POINTS LIST**

## **Building - 3136**

Point Description	Binary Input	Analog Input	Binary Output	Analog Output
Fan Coil Units (Typ. of 47)				
Fan Start/Stop			X	
Chiller				
Chilled Water Supply Temperature		X		
Chilled Water Return Temperature		X		
Chiller Start/Stop			X	
Chiller Status	X			
Hot Water Convertor				
Steam Supply Pressure		X		
Hot Water Supply Temperature		X		
Hot Water Return Temperature		X		
Steam Valve				X
Dual Temperature Water Loop				
DTW Supply Temperature		X		
DTW Return Temperature		X		
DTW Pump Start/Stop			X	
DTW Pump Status	X			
Changeover Valve (Typ. of 2)			X	

The system as described above will require an initial investment of approximately \$48,614 and result in an estimated savings of \$32,715 over the study life. When compared to the existing baseline condition this ECO will result in an savings-to-investment ration (SIR) of .67 and there is no payback.

The following pages include the building simulation calculation and life cycle cost analysis results for the baseline conditions as well as each ECO.

## Building Simulation Results - Baseline Condition and ECO #1

#### ANNUAL ENERGY COSTS

Building: Building 3136 - Baseline 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1 of 1

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy		< <b>-</b> -	Annual (\$)	Costs> (\$/sqft)*	% o Tota	
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	82975 0 0 0 413 0	kWh 1000	lb	1633 0 0 0 0 3292 0	0.139 0.000 0.000 0.000 0.280 0.000	16.4 0.0 0.0 0.0 33.0	* * * *
>>> HVAC Subtotal				4925	0.419	49.4	ક
Electric Natural Gas Fuel Oil Propane Remote Heating	256487 0 0 0 0		lb	5048 0 0 0	0.429 0.000 0.000 0.000 0.000	50.6 0.0 0.0 0.0	ક્ષ ક્ષ ક
>>> Non-HVAC Subtotal				5048	0.429	50.6	₽ 8
>>> GRAND TOTAL				9973	0.848	100.0	₹ -

<sup>\*</sup> Cost per unit floor area is based on the gross building floor area.

Gross floor area.....: 11760 sqft Conditioned floor area....: 10600 sqft

#### FORT BELVOIR, VIRGINIA

# Building Simulation Results - ECO #2

#### ANNUAL ENERGY COSTS

## TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy		<	Annual (\$)	Costs> (\$/sqft)*	% of Total
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	75724 0 0 0 0 228 0	kWh	lb	1490 0 0 0 1818	0.127 0.000 0.000 0.000 0.155 0.000	17.8 % 0.0 % 0.0 % 0.0 % 21.8 % 0.0 %
>>> HVAC Subtotal			<b></b>	3308	0.281	39.6 %
Electric Natural Gas Fuel Oil Propane Remote Heating	256487 0 0 0 0	kWh	1b	5048 0 0 0	0.429 0.000 0.000 0.000 0.000	60.4 % 0.0 % 0.0 % 0.0 % 0.0 %
>>> Non-HVAC Subtotal				5048	0.429	60.4 %
>>> GRAND TOTAL	======	====:	======	8356	0.711	100.0 %

<sup>\*</sup> Cost per unit floor area is based on the gross building floor area.

Gross floor area....: 11760 sqft Conditioned floor area....: 10600 sqft

#### FORT BELVOIR, VIRGINIA

## Building Simulation Results - ECO #3

#### ANNUAL ENERGY COSTS

#### TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy		<	Annual (\$)	Costs> (\$/sqft)*	% of Total
Electric Natural Gas Fuel Oil Propane Remote Heating Remote Cooling	75724 0 0 0 0 228 0	kWh	1b	1490 0 0 0 1818	0.127 0.000 0.000 0.000 0.155 0.000	17.8 % 0.0 % 0.0 % 0.0 % 21.8 % 0.0 %
>>> HVAC Subtotal				3308	0.281	39.6 %
Electric Natural Gas Fuel Oil Propane Remote Heating	256487 0 0 0 0		lb	5048 0 0 0 0	0.429 0.000 0.000 0.000 0.000	60.4 % 0.0 % 0.0 % 0.0 % 0.0 %
>>> Non-HVAC Subtotal				5048	0.429	60.4 %
>>> GRAND TOTAL	======	====:	======	8356	0.711	100.0 %

<sup>\*</sup> Cost per unit floor area is based on the gross building floor area.

Gross floor area.....: 11760 sqft Conditioned floor area....: 10600 sqft

1 NOVEMBER 1995

#### Life Cycle Cost Analysis - ECO #1 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG3136BASE ALTERNATIVE: BLDG3136-FMR

## PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004) STUDY PERIOD:

3.1% Real (exclusive of general inflation) DISCOUNT RATE:

BASE CASE LCC FILE: 3136BASE.LCC ALTERNATIVE LCC FILE: 3136-FMR.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

TMINIAL INVECTMENT THEN (C)	BASE CASE: BLDG3136BASE	ALTERNATIVE: BLDG3136-FMR	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S): CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$558	-\$558
SUBTOTAL FUTURE COST ITEMS:	\$0	\$558	-\$558
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$19,902 \$100,793	\$19,902 \$96,79 <b>4</b>	\$0 \$3,999
SUBTOTAL	\$120,694	\$116,695	\$3,999
TOTAL P.V. LIFE-CYCLE COST	\$120,694	\$117,253	\$3,442

NET SAVINGS FROM ALTERNATIVE BLDG3136-FMR COMPARED TO ALTERNATIVE BLDG3136BASE

Net Savings = P.V. of non-investment savings \$3.999 Increased total investment \$558 Net Savings: \$3,442

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR) FOR ALTERNATIVE BLDG3136-FMR COMPARED TO ALTERNATIVE BLDG3136BASE

> P.V. of non-investment savings SIR = ---- = 7.17 Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR) FOR ALTERNATIVE BLDG3136-FMR COMPARED TO ALTERNATIVE BLDG3136BASE (Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 25.55%

ESTIMATED YEARS TO PAYBACK

FORT BELVOIR, VIRGINIA

1 NOVEMBER 1995

Simple Payback occurs in year 2 Discounted Payback occurs in year 2

#### ENERGY SAVINGS SUMMARY

Energy	Units	Annı	ual Consumption	n	Life-Cycle
type		Base Case	Alternative	Savings	Savings
Electricity	kWh	346,101	346,101	0	0
Central Steam	Pound	433,650	433,650	0	0

#### EMISSIONS REDUCTION SUMMARY

Energy type	Annual Base Case	Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	201.0	201.0	0.0	0.0
SOx (Kg):	1,689.2	1,689.2	0.0	0.0
NOx (Kg):	862.3	862.3	0.0	0.0
Central Steam:				
CO2 (Kg):	0.0	0.0	0.0	0.0
SOx (Kg):	0.0	0.0	0.0	0.0
NOx (Kg):	0.0	0.0	0.0	0.0
Total:				
CO2 (Mg):	201.0	201.0	0.0	0.0
SOx (Kg):	1,689.2	1,689.2	0.0	0.0
NOx (Kg):	862.3	862.3	0.0	0.0

## Life Cycle Cost Analysis - ECO #2 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG3136BASE ALTERNATIVE: BLDG3136-PLC

# PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004) DISCOUNT RATE: 3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 3136BASE.LCC ALTERNATIVE LCC FILE: 3136-PLC.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

TNITETAL INVECEMENT INCM/C).	BASE CASE: BLDG3136BASE	ALTERNATIVE: BLDG3136-PLC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S): CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$10,646	-\$10,646
SUBTOTAL	\$0	\$10,646	-\$10,646

#### **ENERGY MANAGEMENT SYSTEM (EMS) STUDY**

CORT BELVOID VIDGINIA

FORT BELVOIR, VIRGINIA		I NOVEMBER 1995	
FUTURE COST ITEMS: ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$19,902 \$100,793	\$19,902 \$82,855	\$0 \$17,938
SUBTOTAL	\$120,694	\$102,757	\$17,938
TOTAL P.V. LIFE-CYCLE COST	\$120,694	\$113,403	\$7,292

NET SAVINGS FROM ALTERNATIVE BLDG3136-PLC COMPARED TO ALTERNATIVE BLDG3136BASE

Net Savings = P.V. of non-investment savings \$17,938 - Increased total investment \$10,646 Net Savings: \$7,292

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG3136-PLC COMPARED TO ALTERNATIVE BLDG3136BASE

P.V. of non-investment savings
SIR = ----- = 1.68
Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG3136-PLC COMPARED TO ALTERNATIVE BLDG3136BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 8.62%

#### ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 6 Discounted Payback occurs in year 7

#### ENERGY SAVINGS SUMMARY

Energy	Units	Ann	ual Consumption	n	Life-Cycle
type		Base Case	Alternative	Savings	Savings
Electricity	kWh	346,101	335,997	10,104	101,040
Central Steam	Pound	433,650	239,400	194,250	1,942,500

#### EMISSIONS REDUCTION SUMMARY

Energy	Annual	Emissions	Annual	Life-Cycle
type	Base Case	Alternative	Reduction	Reduction
Electricity: CO2 (Mg): SOx (Kg): NOx (Kg): Central Steam:	201.0	195.2	5.9	58.7
	1,689.2	1,639.8	49.3	307.7
	862.3	837.1	25.2	251.7
CO2 (Kg):	0.0	0.0	0.0	0.0

A MONTH CREEK TOOK

# ENERGY MANAGEMENT SYSTEM (EMS) STUDY FORT RELYOIR VIRGINIA

	FORT BELVOIR, VIRGINI	IA.			1 NOVEMBER 1995
SOx	(Kg):	0.0	0.0	0.0	0.0
NOx	(Kg):	0.0	0.0	0.0	0.0
Tota:	1:				
CO2	(Mg):	201.0	195.2	5.9	58.7
SOx	(Kg):	1,689.2	1,639.8	49.3	307.7
NOx	(Kg):	862.3	837.1	25.2	251.7

1 NOVEMBER 1995

## Life Cycle Cost Analysis - ECO #3 vs. Baseline

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG3136BASE ALTERNATIVE: BLDG3136-DDC

#### PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)

DISCOUNT RATE: 3.1% Real (exclusive of general inflation)

BASE CASE LCC FILE: 3136BASE.LCC ALTERNATIVE LCC FILE: 3136-DDC.LCC

#### COMPARISON OF PRESENT-VALUE COSTS

INITIAL INVESTMENT ITEM(S):	BASE CASE: BLDG3136BASE	ALTERNATIVE: BLDG3136-DDC	SAVINGS FROM ALT.
CASH REQUIREMENTS AS OF SERVICE DATE	\$0	\$48,614	-\$48,614
SUBTOTAL FUTURE COST ITEMS:	\$0	\$48,614	-\$48,614
ANNUAL AND NON-AN. RECURRING COSTS ENERGY-RELATED COSTS	\$19,902 \$100,793	\$10,736 \$77,243	\$9,166 \$23,550
SUBTOTAL	\$120,694	\$87,979	\$32,715
TOTAL P.V. LIFE-CYCLE COST	\$120,694	\$136,593	-\$15,899

NET SAVINGS FROM ALTERNATIVE BLDG3136-DDC COMPARED TO ALTERNATIVE BLDG3136BASE

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG3136-DDC COMPARED TO ALTERNATIVE BLDG3136BASE

P.V. of non-investment savings
SIR = ----- = 0.67
Increased total investment

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG3136-DDC COMPARED TO ALTERNATIVE BLDG3136BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = -0.90%

ESTIMATED YEARS TO PAYBACK

FORT BELVOIR, VIRGINIA

1 NOVEMBER 1995

Simple Payback never reached during study period Discounted Payback never reached during study period

#### ENERGY SAVINGS SUMMARY

Energy	Units	Anni	ual Consumptio	n	Life-Cycle
type	•	Base Case	Alternative	Savings	Savings
Electricity	kWh	346,101	332,211	13,890	138,900
Central Steam	Pound	433,650	228,000	205,650	2,056,500

#### EMISSIONS REDUCTION SUMMARY

Energy type		Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	201.0	193.0	8.1	80.7
SOx (Kg):	1,689.2	1,621.4	67.8	423.0
NOx (Kg):	862.3	827.7	34.6	346.1
Central Steam:				
CO2 (Kg):	0.0	0.0	0.0	0.0
SOx (Kg):	0.0	0.0	0.0	0.0
NOx (Kg):	0.0	0.0	0.0	0.0
Total:				
CO2 (Mg):	201.0	193.0	8.1	80.7
SOx (Kg):	1,689.2	1,621.4	67.8	423.0
NOx (Kg):	862.3	827.7	34.6	346.1

## Recommendations

**Energy Management System Evaluation Matrix** 

FUNCTION	PLC <sup>.</sup>	DDC
Hot Water Reset	0	1
Supply Air Reset		
Chilled Water Reset	0	1
Enthalpy Economizer		
Time of Day Scheduling	10	10
Demand Limiting (Installation Wide)	0	2
Centralized Control	0	1
Centralized Monitoring	0	2
Expandability	1	2
Flexibility	2	2
Maintenance Scheduling	0	2
Optimum Start	1	1
Occupant Control/Override	1	1
Comfort Control	0	. 2
Reliability/Maintainability	11	2
Effect on Equipment Life	1	2
Maintenance Costs	1	1
Savings to Investment Ratio (SIR)	10	0
Total	28	32

The evaluation matrix above is intended to provide an objective comparison of two systems with widely varying capabilities. This matrix assigns relative value to the factors which were identified as being important in evaluating an EMS. From the results of this evaluation matrix the merits of the DDC system surpass those of the PLC system for this Building. The DDC system offers the greatest benefit for this building with respect to total Installation wide energy savings and HVAC system operation and maintenance. This

system; however, does not provide a pay-back with-in the life of this study and does not qualify for funding under the current ECIP criteria.

The life cycle cost analyses indicated that the FMR and PLC systems meet the ECIP criteria.

The age and condition of the fan coil units and the control system in this building make it a candidate for a mechanical system replacement. An example is that the fan coil units are not equipped with control valves to stop the flow of water through coil when cooling or heating is not needed. This situation causes the fan coil units to act as radiators during the heating season even after the thermostat has been satisfied and has cycled the fan off. The installation of total system EMS at the time of new equipment installation would be more cost effective.

The building is served by a packaged air cooled chiller which can be cycled to provide electrical demand savings. This building should be equipped with and FMR relay and entered into a demand limiting schedule in accordance with the strategy outlined in Example 2.1 of this report.

**APPENDICES** 

# APPENDIX A FIELD SURVEY DATA SHEETS

**BUILDING 200** 

## Air Cooled Condensing Unit Survey Data Sheet

Project Name: 47 BELVOIR EMS STUD	<i>&gt;</i> Y
Project Number: 60692	
Building: 200	
Unit No. Acw-1 Location Brills B10's	Area Served
Compressors: Reciprocating	
Rotary	Number/
Rolary	Horespower
	FLA 211
Fans:	LAA <u>791</u>
Number6	Harranawar / 5
RPM /075	Horsepower 1.5
	14
Electrical:	
Volts Zee	Phase 3
FLA	Hertz /00
GROOK	
Manufacturer TRANS	1.7.
Model RAVA - COCGEA -CYPE	601-0181-1A
Souther 36-13374	
Controls:	
	Starter
HOA Switch	, S.
Remarks:	,
CONFRESSULS ARE EQUA	50 W UNLOADERS WHICH NERE
DISCONNECTED AT TIME OF	SUPVEY

Continue Served.

# Air Cooled Condensing Unit Survey Data Sheet

Project Name: HELVOIR EN	15 Shoy
Project Number: 66696.00	
Building: 200	
Unit No. ALLV-L Location BEHIND BE	Area Served GHILLER C-1
Compressors:  Reciprocating X  Rotary	Number Horespower FLA _2!/   1991
Fans: Number 4 RPM 1075	Horsepower <u>15</u>
Electrical:  Volts 200  FLA	Phase 3 Hertz 40
Manufacturer TRANE  Model RAVA - 6006 - EA  3664 36 - 13373	7486 621-0181-1A
Controls:  None  HOA Switch	Motor Starter
Remarks:	

Project Name: FT BOYOUR EMS STUDY Project Number: 60690.00	
alding: 200	
Unit No. AHD-1 Location REAR MECH. ROOM	Area Served
Air Type: Constant Volume	Variable Volume
Zone Type: Single Zone	Multi-Zone
Cooling: Chilled Water None	DX
Heating: Hot Water Electric	Steam None
Supply Fan: Forward Curved Backward Incline Airfoil	Controls: Inlet Vanes Variable Frequency Drive Motor Starter HOA Switch
nfiguration: Blow-Thru Draw-Thru	Horizontal Vertical
Motor  Horespower Phase Hertz	Volts ZOO Amps
Manufacturer TRANS CUMPTE CHANGE  Model M-12 SETUR	ER K3)247369
Return Air Fan: Fan No. Return	None
Economizer Controls:  None Outdoor Enthalpy Drybulb Comparison	Outdoor Drybulb Enthalpy Comparison
Remarks: 3 way PREVINETU VALVE	E CHILLED of HOT WATER.

Project Name: The Local Project Name:	<del></del>
Project Number: 606 97.00	
Building: 200	
Unit No. RAT Location REAR MECH. ROOM	Area Served AHU-I
Fan Type:	
Power Roof Ventilator Utility Fan Inline Centrifugal Ceiling Centrifugal	Forward Curved Backward Incline Airfoil
Motor:	
Horespower Phase Hertz	Volts <u>Loo</u> Amps <u></u> RPM
Manufacturer	
	Starter X While Locay Dele Frequency Drive
Remarks:	H MOTOR NAMEPLATE

Project Name: 17 Project Number: 60692.60	
ailding: 200	
Unit No. AHU 2 Location ME 2370 No.	Area Served
Air Type: Constant Volume	Variable Volume
Zone Type: Single Zone	Multi-Zone
Cooling: Chilled Water None	DX
Heating: Hot Water Electric	Steam None
Supply Fan: Forward Curved Backward Incline Airfoil	Controls: Inlet Vanes Variable Frequency Drive Motor Starter HOA Switch
nfiguration: Blow-Thru Draw-Thru	Horizontal Vertical
Motor Horespower 10 Phase 1746 April	Volts 100 Amps 34,4 HoA \$ 05
Manufacturer TANE CLIMATE GHA Model 7W6 17-71 950	MERX n= K3J247372_
Return Air Fan: Fan No. RAF-2	None
Economizer Controls:  None Outdoor Enthalpy Drybulb Comparison	Outdoor Drybulb Enthalpy Comparison
Remarks: 3 - Zanes R	SEVERACIC ACTUATORS TOR ZONE DAME
3-way Varios	an received of Hot warde
Promotile Return	EN RELEF & OA SAMOERS
1	

A-6

Project Name: 100092 00 Project Number: 100092 00	14 · · · · · · · · · · · · · · · · · · ·
Building: 200	
Unit No. RE LLocation MECCANINE	Area Served
Fan Type:  Power Roof Ventilator  Utility Fan  Inline Centrifugal  Ceiling Centrifugal	Forward Curved
Motor:  Horespower Phase 3 Hertz 100	Volts Zeo Amps RPM
Manufacturer	
Controls:  None Motor S  Inlet Vanes Variabl  HOA Switch	Starter e Frequency Drive
Remarks: DS & Motor S	PARTER & P.E. RELAY
Noma 5/26 0 Mo	10R STARTER SQUACE D
200/230	KY 3HP
COULD NOT REACH	MOTOR NAMEPLATE

Project Name: FT PELYOIR EMS STUDY Project Number: 60692.00		
uilding: 200		
Unit No. Atto 3 Location MEZZANINE	Area Served	
Air Type: Constant Volume	Variable Volume	
Zone Type: Single Zone	Multi-Zone	
Cooling: Chilled Water None	DX	
Heating: Hot Water	Steam None	
Supply Fan: Forward Curved Backward Incline Airfoil	Controls: Inlet Vanes Variable Frequency Drive Motor Starter HOA Switch	
nfiguration: Blow-Thru Draw-Thru	Horizontal Vertical	
Motor Horespower Phase Hertz 60	Volts 200-208 Amps 10.6 1760-8M	
Manufacturer TRANETE CLIMATE	CHANGER	
Return Air Fan: Fan No. 14	None	
Economizer Controls:  None Outdoor Enthalpy Drybulb Comparison	Outdoor Drybulb Enthalpy Comparison	
Remarks:		
3. WAY VALUES CO	HILLED WATER & HOT WATER	
PNEUMATIC RETURN, RELIEF	\$ OA DAMPER AC	

A-8

Project Name: FI BOUOLE BYS STUDY Project Number: 60092.00		
Building: Zoo		
Unit No. RAT 3 Location	Area Served AHU - 3	
Fan Type:  Power Roof Ventilator  Utility Fan  Inline Centrifugal  Ceiling Centrifugal	Forward Curved Backward Incline Airfoil	
Motor:  Horespower  Phase  Hertz	Volts <b>200</b> Amps RPM	
Manufacturer TRANS  Model U-24-B1		
Controls:  None Motor Inlet Vanes Variab HOA Switch	Starter	
Remarks: Motor	STANION W/ P. T. Cory	
COULD NOT REACH MOTOR WAMBPLATE		

Project Name: FT BEVOIR EMS STUDY Project Number: 60692 000	
uilding: 200	
Unit No. AHU. Hocation MECEBONNE	Area Served
Air Type: Constant Volume	Variable Volume
Zone Type: Single Zone	Multi-Zone Multi-Zone
Cooling: Chilled Water X None	DX
Heating:  Hot Water Electric	Steam None
Supply Fan: Forward Curved Backward Incline Airfoil	Controls: Inlet Vanes Variable Frequency Drive Motor Starter HOA Switch
onfiguration: Blow-Thru Draw-Thru	Horizontal Vertical
Motor Horespower Phase Hertz	Volts <u>2000</u> Amps <u>16.6</u> 176 Am
Manufacturer GRANE CLIM Model M 2-14	NATE CHANGEL
Return Air Fan: Fan No. RAF-4	None
Economizer Controls:  None Outdoor Enthalpy Drybulb Comparison 7	Outdoor Drybulb Enthalpy Comparison
Remarks: 7 Jungs	H PNOVMATIL BONE DAMPOR RECURTORS
PHOUMA	THE 3-WAY HAVES CHILLED WATER + HOT!
1	· · · · · · · · · · · · · · · · · · ·

A-10

Project Name: FI BEWOR 6MS SWY Project Number: 60697, 60		
Building: 200		
Unit No. RAF Location	MEGANINE	Area Served ##U - 4
Fan Type:		
Power Roof Ventilate Utility Fan Inline Centrift gal Ceiling Centrifugal	·	Forward Curved Backward Incline Airfoil
Motor:		700
Horespower Phase <u>\$</u>		Volts Zoo Amps
Hertz <u>60</u>		RPM
Manufacturer	11-271-	<b>81</b>
****	SELM!	K3 2248023
Controls: None	Motor S	Starter N W HOA & PB. Row
Inlet Vanes		e Frequency Drive
Remarks:	COULD NOT RE	ACH MUTOR NAMBRIATE
		· · · · · · · · · · · · · · · · · · ·

Project Name: FT DOLVO: Project Number: 60016.00	R EMS SOUDY
lding: <u>200</u>	
Unit No. AHU: 5 Location	BEBANINE Area Served
Air Type: Constant Volume	Variable Volume
Zone Type: Single Zone	Multi-Zone
Cooling: Chilled Water None	DX
Heating: Hot Water Electric	Steam None
Supply Fan: Forward Curved Backward Incline Airfoil	Controls: Inlet Vanes Variable Frequency Drive Motor Starter HOA Switch
nfiguration: Blow-Thru Draw-Thru	Horizontal
Motor Horespower Phase Hertz	Volts 700 Amps 16.6 (760 RPM
Manufacturer	AND CLIMATE CHUNEGR
Return Air Fan: Fan No.	None
Economizer Controls:  None Outdoor Enthalpy Drybulb Comparison	Outdoor Drybulb Enthalpy Comparison
Remarks:	MATIC 3-MAY VALUES CHILLED & (NOT CHATER

A-12

Project Name: 19 BEVOIR EMS 9	DDY
Building: 200	
Unit No. RESLOCATION MESSANINE	Area Served AHV-5
Fan Type:  Power Roof Ventilator  Utility Fan  Inline Centrifugal  Ceiling Centrifugal	Forward Curved
Motor:  Horespower Phase Hertz	Volts Amps RPM
Manufacturer TRANE Model   10 - 27 - 8	)
None Motor	Starter A W P.E. LERM le Frequency Drive
Remarks: Could Not R	BACH MOTOR NAMERIATE
· · · · · · · · · · · · · · · · · · ·	

Project Name: FT BEZ VOIR EMS STUDY Project Number: 60092.00	
ilding: <u>200</u>	
Unit No. AHNO Location KEAR MECH. NEXT	Area Served
Air Type: Constant Volume	Variable Volume
Zone Type: Single Zone	Multi-Zone
Cooling: Chilled Water None	DX
Heating:  Hot Water X  Electric	Steam None
Supply Fan: Forward Curved Backward Incline Airfoil	Controls: Inlet Vanes Variable Frequency Drive Motor Starter
nfiguration: Blow-Thru Draw-Thru	Horizontal Vertical
Motor  Horespower Phase Hertz	Volts 200 Amps
ManufacturerTRANE CUMATE  Model	CHANGER
Return Air Fan: Fan No	None X
Economizer Controls:  None Outdoor Enthalpy Drybulb Comparison	Outdoor Drybulb Enthalpy Comparison
Remarks: WO 6 DUTH OF AIR	<del></del>
·	

A-14

Project Name: 16 DECVOIR Project Number: 1006 92, 00	1072-
Building: 200	
Unit No. L Location	Area Served
Fan Type:  Power Roof Ventilator  Utility Fan  Inline Centrifugal  Ceiling Centrifugal	Forward Curved Backward Incline Airfoil
Motor:	
Horespower Phase Hertz	Volts Amps RPM
Manufacturer	
Controls:  None Inlet Vanes HOA Switch	Motor Starter Variable Frequency Drive
Remarks:	

Project Name: Froject Number: October 1995 Stuff	
Building: 700	
Unit No. Ef & Location	Area Served
Fan Type:  Power Roof Ventilator  Utility Fan  Inline Centrifugal  Ceiling Centrifugal	Forward Curved Backward Incline Airfoil
Motor:  Horespower Phase Hertz	Volts Amps RPM
Manufacturer	
Controls:  None Motor S  Inlet Vanes Variable  HOA Switch	Starter e Frequency Drive
Remarks:	

Project Name: 17 DEC/OIR EMS Project Number: 100 697	STON
Building: 4/	
Unit No. EF Location MEZERUNE	Area Served
Fan Type: Power Roof Ventilator Utility Fan	Forward Curved Sackward Incline
Inline Centrifugal Ceiling Centrifugal	Airfoil
Motor: Horespower	V. I.
Phase	Volts
Hertz	Amps RPM
Manufacturer ARMS  Model U- 963-	60
Model <u>U- 963-</u>	rc
Controls:	
	toutou
	tarter
HOA Switch	Frequency Drive
Remarks:	Marie a sa a como de
COULD NOT KENCH	MOTOR NAME PLATE
OUTLER MAMINER 3	WAP SWITCH W/INDICATOR LIGHT

Project Name: HOWYOR EMG 67 Project Number: 60692.00	
Building: 200	
Unit No. [W-] Location	Area Served
Fan Type:  Power Roof Ventilator  Utility Fan  Inline Centrifugal  Ceiling Centrifugal	Forward Curved Backward Incline Airfoil
Motor:  Horespower Phase Hertz	Volts Amps RPM
Manufacturer	
Controls: None	Motor Starter Variable Frequency Drive
Remarks:	

#### Fan Data Sheet

Project Name: 17 DEWOIR EMS STODY Project Number: 60692.00	<u>Y</u>
Building: 200	
Unit No. 160-Z Location ROOF	Area Served
Fan Type:  Power Roof Ventilator  Utility Fan Inline Centrifugal Ceiling Centrifugal	Forward Curved Backward Incline Airfoil
Motor:	
Horespower Phase Hertz	Volts Amps RPM
Manufacturer	
Controls:	
None	Motor Starter Variable Frequency Drive
Remarks:	

Project Name: The Work EMS Study Project Number: 60090,00
Building: <u>100</u>
Unit No. AM Location ENTRY VESTIBULE Area Served ENTRY VESTIBULE
Cooling: Chilled Water None \( \sum_{\cup} \)
Heating:  Hot Water  Steam  Electric KW  None
Fan Motor
Electrical:   Volts
Manufacturer
Controls:  Self Contained Remote \( \bigcup \) T-STAT  Outside Air \( \bigcup \) FAN SAEED SWITCH
Remarks:

Project Name: FT BELVON Project Number: 6000	C BMS STUDY		
Building:			
Unit No. CM. 2 Location	TRY VESTIBULE	Area Served	TRY VESTIBULE
Cooling:  Chilled Water None			
Heating:      Hot Water     Steam     Electric KW     None			
Fan Motor Horespower Phase Hertz	Volts Amps RPM		·
Electrical:  Volts  Hertz	Phase FLA		
Manufacturer TRANE  Model			
Controls:  Self Contained Outside Air	Remote _	X T.STAT # FAN	Steed Switch
Remarks:		<b>'</b>	·

Project Name: The York EMS STUDY Project Number: BUST. C.
Building:
Unit No. 16-1 Location KEAR MERH Krom Area Served ENTILE BURS
Motor:  Horespower Volts
Phase
Controls:  None Variable Frequency Drive  Motor Starter HOA Switch
Remarks: HEAGING SURFACE 289 SYFT
6ROSS OUTROT 1339
WET RATING 1165
40 HP
6/L 12 GPH
GKS Z MBH
BURNEL MODEL 58-0-05
7.06PH MIN
12. 6PM MAX
BURNER 28 37 1.9 AND
On only

Project Name: HOELVOIR EMS STUDY
Project Number: bold77, ••
Unit No. 1 Location LEAR MECH from Area Served CHILLEY WATER
Motor:  Horespower 7.5  Phase 3  Volts 200-2018  Amps 23
Hertz (200 RPM 1750
Manufacturer DOL & GOSSETT  Model 4BB - 8 - 18 BF
Controls:
None Variable Frequency Drive  Motor Starter HOA Switch
Remarks: BASE MOUNTED END SUCTION

Project Name: FI DELVOIR EMS EUVI Project Number: 50692:00
Building: 200
Unit No. P. Z Location REAR MECH. Ru Area Served HOT WATER Run
Motor:  Horespower 3 Phase 4 Hertz 4 RPM 1725
Manufacturer BELL & GUSSET  Model Z'/2 AB 7/MP SEXIES   5/1
Controls:  None Variable Frequency Drive  Motor Starter HOA Switch
Remarks: BASE MOUNTED GND - SULTION

Project Name: FOELVOIR EUS SCUOT Project Number: 40672, 00
Building: 200
Unit No. P. 5 Location ROAR MECH Room Area Served _ STANDBY Runs
Motor:  Horespower 3 Phase 3 Hertz 20 RPM 745
Hertz Leo RPM 1745
Manufacturer
Controls:  None Variable Frequency Drive  Motor Starter HOA Switch
Remarks: BEE MOUNTED END SUZTION
·

Project Name: FT BEYOUR TOMS STUDY
Project Number: 60692, 00
Building:
Unit No. Location REAR MEURA Area Served Atto-6
Motor:  Horespower Volts Phase Amps
Hertz RPM
ManufacturerBEU-+ COSETT
Controls:  None Variable Frequency Drive  Motor Starter HOA Switch
Remarks: WILDE HAMMER SWARD SWITCH & INDICATOR LIGHT
IN UNE CONTRINGER

Project Name: VT VECCOL TEMS SCAPE  Project Number: 60097.00
Building:
Unit No. P-5 Location REAR MEHRM Area Served FINDED TUBE
Motor:
Horespower Volts  Phase Amps  Hertz RPM
Manufacturer
Controls:  None Variable Frequency Drive  Motor Starter HOA Switch
Remarks:  (C. LORA CONTLOUE)  SOUTH HAMBER SWAP SINITCH by INDICATION LIGHT
MUNE CONTEMENT SWEET BY INDICATOR CLOSET
There way where

**BUILDING 219** 

# Boli ER

Project Name: FT BEZUAR EMS			
Project Number: 60677, 00			*
Building: 219 A			
Unit No. B Location BASEMENT M	ECH <b>fM</b> Area Served	ENTIRE	BLDG
Motor:			
	olts		
	amps		
Hertz	PM		
Manufacturer WEIL McLEAN	1		
Model BOILER MODEL CO		DE READ	
Controls:			
	Frequency Drive		
Motor Starter HOA Swi	tch		
Remarks: FEABOOY GOIL	oon PATT	BURNBR	OIL FIRED
19 694	RUS	8,2-0-1	٥
· 1	· · · · · · · · · · · · · · · · · · ·		
- AET	IRON		
	INDIO		
			•
15851	LEWET VA	LVE	<u> </u>

HN RESET 55 90° 21/2 135 0° 180

# BOILER Pump Data Survey Sheet

Project Name: FT BELVOIR EMS STUDY Project Number: 60692.00
Building: 219
Unit No. B-2 Location AUDITORIUM BASEMONTArea Served ENTIRE BLDG
Motor:       Horespower       Volts         Phase       Amps         Hertz       RPM
Manufacturer WEIL Mc LATN  Model NO NAME PLATE FOUND
Controls:  None Variable Frequency Drive  Motor Starter HOA Switch
Remarks:  CAST IRON BOILER  PEABOON GORDON PIATT OIL BURNER  19 GAH

#### Chiller Survey Data Sheet

Project Name: FT BELVOIR EMS STUDY Project Number: 60092.00	
Building: 219	
Unit No. C-1 Location South MECH Room Area Se	rvedBLD6_Z19
Compressors:  Reciprocating  Centrifugal  Rotary	Number 2 Horespower
Condenser Type:  Air Cooled Packaged  Air Cooled Split (Condensing Unit)	Air Cooled Remote (Condenser (Water Cooled (Cooling Tower))
Electrical: Volts 460 FLA	Phase <u>3</u> Hertz <b>60</b>
Manufacturer TRANE  Model CCVA0604 MB 5	1 DF 4C4C 36) CEH
Controls: SELM L78CI  None HOA Switch Motor Starter	1022
Remarks: GOMPRESSORS TRANS  R-22 460 V39 50  ERA 240  RLA 55.0	CRHM 300C-26 AT ERIAL A 7M 30A 3003 11 4 A 7M 30A 2999

(po Ton

# Air Cooled Condenser Survey Data Sheet

Project Name: FT BELVOIR EMS STUDY Project Number: 60692,00	
Building: 219	
Unit No. ACC Location ONE SOUTH MED	4 Area Served <u>BU6 219 - C-1</u>
Fans: Number 2 RPM	Horsepower 7.5  11.0 F.A (EA)
Volts — Volts — MCA 25	Phase 3 Hertz 60
Manufacturer Kares Model CAVA -	8004-0A
Controls:	r Starter
Remarks:	

#### Chiller Survey Data Sheet

Project Name: FT BELVOIR EMS STUDY Project Number: 60692.00	
Building: ZMA	
	urea ServedBUNG Z19 A
Compressors:	_
Reciprocating	Number 2
Centrifugal	Horespower
Rotary	RIA 40,0
Condenser Type:	KUI 407
Air Cooled Packaged X	Air Cooled Remote(Condenser)
Air Cooled Split (Condensing Unit)	Water Cooled (Cooling Tower)
Electrical:	-
Volts 460	Phase 3
FLA 50 AMP (EA) 2 CIRCUITS	Phase 3 Hertz 65
100-016	110122
ModelCGAAO401 NB5	7CC4C4C36/BEJ
Controls:	8K 13974 328-839-01
None Motor Star	78-839-01
HOA Switch	
Remarks: 2 Completes 460	V-34-60 HR RLA 40,0 CRA /;
0 (100 100)	1 99-60 HE 144 7014 CAN 11
	•

40 Ton

Project Name: FT BEZYOR EMS STUDY Project Number: 60692.00	
ilding: 219A	
Unit No. AHU 1 Location AND TORIUM MEZH ROOM	_ Area Served AUDITORIUM
Air Type: Constant Volume	Variable Volume
Zone Type: Single Zone	Multi-Zone
Cooling: Chilled Water X None 2 PIPE	DX
Heating: Hot Water Electric  Hot Water	SteamNone
Supply Fan: Forward Curved Backward Incline Airfoil	Controls: Inlet Vanes Variable Frequency Drive Motor Starter HOA Switch
nfiguration: Blow-Thru Draw-Thru	Horizontal Vertical
Motor Horespower 3 Phase 3 Hertz 6	Volts Amps
Manufacturer 50HU FANT TRANE	1DW3CWU85H
	-0015-1A SECURE K 78-141473 None
Economizer Controls:  None Outdoor Enthalpy Drybulb Comparison	Outdoor Drybulb
Remarks: FIELD BUILT - W	
2- WAY ENEUMATIN	VALUE FOR WATER
	NEUMATIC CONTENS
JOHNSON CONTROLS NI-90	MO ENTHATON INGIL CONTONLED
KI-Z SUMMER CONTROL 7	16 DA DA 9,24 DA
RC-3 ALMIDITY CONTROL A S	713 RA

Project Name: FT BUDAR EMS STUDY Project Number: 6069200	
ailding: 219	
Unit No. AHU B Location SOVIH MEH RM	Area Served NTERINE BONE
Air Type: Constant Volume	Variable Volume
Zone Type: Single Zone	Multi-Zone
Cooling: Chilled Water None Z FIE	DX
Heating:  Hot Water Electric	Steam None
Supply Fan:  Forward Curved  Backward Incline  Airfoil	Controls: Inlet Vanes Variable Frequency Drive Motor Starter X HOA Switch X
onfiguration: Blow-Thru Draw-Thru	Horizontal Vertical
Motor  Horespower Phase Hertz  15  Horespower Phase Hertz	Volts 230/460 Amps 24/12
Manufacturer TRANE CUMATE CHANGE  Model TYPE L-31	R 3BRIAL# K78C32075
Return Air Fan: Fan No	None
Economizer Controls:  None Outdoor Enthalpy Drybulb Comparison	Outdoor Drybulb Enthalpy Comparison
Remarks: BAKBEL LOVEMAN PHEUR	MATIC CONTROLS
MAINATIC 3 WAY	

A-35

#### Fan Data Sheet

Project Name: FT BELVEIR EMS ST	WY_
Project Number: 60692.00	
Building: <u>2/9</u>	
Unit No. <u>RAF-</u> Location <u>ATTIC</u> blas 2	Area ServedAHU-1
Fan Type:	
Power Roof Ventilator	Forward Curved
Utility Fan	Backward Incline
Inline Centrifugal Ceiling Centrifugal	Airfoil
Motor:	
Horespower	Volts
Phase	Amps
Hertz	RPM
Manufacturer	
Controls:	
None	Motor Starter
Inlet Vanes YOU HOA Switch	Variable Frequency Drive
HOA SWIICH	
Remarks:	

Project Name: 11 DELVOIR E195 91007	
ailding: 219	
Init No. AHV-2 Location BASEMENT US ROOM	Area Served
ir Type: Constant Volume	Variable Volume
Cone Type: Single Zone	Multi-Zone
Cooling: Chilled Water None	DXX
Heating: Hot Water	Steam v
Electric Supply Fan:	Steam None Controls:
Forward Curved Backward Incline Airfoil	Inlet Vanes Variable Frequency Drive Motor Starter HOA Switch
nfiguration: Blow-Thru Draw-Thru	Horizontal Vertical
Motor  HorespowerPhase	Volts 115 / 208-230 Amps /7.4
Hertz CARCIGO Manufacturer CARCIGO	7 And 2 2 2 1 4 A
, - <b>,</b> -	4007-3016A
Return Air Fan: Fan No	None X
Economizer Controls:  None Outdoor Enthalpy Drybulb Comparison	Outdoor Drybulb Enthalpy Comparison
Remarks: NOT OPERATING AT TIME	OF GURVEY

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#### Air Cooled Condensing Unit Survey Data Sheet

Project Name: F1 BEZVOIR BMS Project Number: 60692,00	STUDY
Project Number: 60642,00	
Building: 219	
Unit No ACW- Location BEHIND BL	DL Area Served AHU-Z UPS ROOM
Compressors:	
Reciprocating	Number _
Rotary	Horespower
	RLA 13.5
Fans:	LRA 69
Number	Horsepawa
RPM	Horsepower
Electrical:	
Volts <u>46</u> 0	Phase 3
MCA 18.1	Hertz 60
Manufacturer CARRIER	
	ං <b>ර</b> ව
Controls:	
None	Motor Starter
HOA Switch	·
Remarks:	
	·

#### Fan Data Sheet

Project Name: FT BEZVAR EMS STUDY Project Number: 60692.00	_
Building: <u>UI</u>	,
Unit No. Ef   Location	Area Served
Fan Type:  Power Roof Ventilator  Utility Fan  Inline Centrifugal  Ceiling Centrifugal	Forward Curved Backward Incline Airfoil
Motor:  Horespower Phase Hertz	Volts Amps RPM
Manufacturer	
Controls: None Motor	Starter ble Frequency Drive
Remarks:	
,	

Project Name: <u>FT BELVOIR</u> EMS S Project Number: <u>60692.00</u>	TUDY :
Building: 219	
Unit No.† <u>C</u> U-A Location	Area Served
Cooling: Chilled Water X None	
Heating:  Hot Water  Steam  Electric KW  None	
Fan Motor Horespower	Volts 1/5 V Amps RPM
Electrical:  Volts  Hertz	Phase FLA
Manufacturer TRANE  Model B22A	1802
Controls:  Self Contained  Outside Air	Remote
Remarks: Z PIPE	W/ ELECTRIC CONTROL VARI/BS

A-40

Project Name: FT BELV Project Number: 60692,00	OIR EMS	STUDY	:	:	Ž.
Building: <u>2/9</u>					٠
Unit No. FOU-B Location		Area Served	7		-
Cooling: Chilled Water None					-
Heating:  Hot Water   Steam  Electric  None	_ KW				
Fan Motor Horespower		Volts Amps RPM			
Electrical: Volts 15V Hertz 60		Phase	e talene		· · · · · · · ·
Manufacturer TRO	NE B2	2A003			- -
Controls:  Self Contained Outside Air		Remote			
Remarks:	PIPE	W/ EUSCERIC	2-way	Conten	VALVE
					- - -
					- -
					- - -
					_

A-41

Project Number: 60692.45	MS STUDY	
Building: 219		
Unit No. FWD Location	Area Served	
Cooling: Chilled Water None		
Heating:  Hot Water X  Steam  Electric KW  None		
Fan Motor Horespower Phase Hertz	Volts Amps RPM	
Electrical:  Volts  Hertz	Phase FLA	
Manufacturer	PANE B22A004	
Controls:  Self Contained Outside Air	Remote	
Remarks: Z P10	B W/ EVERTRIC CONTROL VAC	VB
	-	

Project Name: TT SELVOIR EMS Project Number: 60672,00	SOUDY	
Building: 219		
Unit No FWE Location	Area Served	
Cooling: Chilled Water		
Heating:  Hot Water Steam KW None		
Fan Motor  Horespower	Volts Amps RPM	
Electrical:  Volts  Hertz	Phase FLA	
Manufacturer TEANE Model	1522 A 5506	-
Controls: Self Contained Outside Air	Remote	-:
Remarks: 2	PIPE WEBETRIC CONTR	OL VALVE
		7.

Project Name: FT BEZVOIR BMS STUDY Project Number: 60692.00
Building: <u>219</u>
Unit No. Fw-F Location Area Served
Cooling: Chilled Water None
Heating:  Hot Water
Fan Motor  Horespower 4/12  Phase 4  Hertz — RPM
Electrical:  Volts Phase  Hertz FLA
Manufacturer PANS  Model B22 A008
Controls:  Self Contained Remote Outside Air
Remarks: Z PIPE W FLEXTRIC CONTROL VALVE

A - 44

Project Number: 60692, vo
Building: <u>2/</u> 9
Unit No. P-1A Location BASSUS Area Served AUDITORIUM
Motor:  Horespower 2  Phase 3  Hertz RPM 3450
Manufacturer BELL \$ 6055577  Model 568/63 535 359 7 809
Controls:  None Variable Frequency Drive  Motor Starter HOA Switch
Remarks:

Project Name: FT BELVOIR EMS STOWY Project Number: 60672.60
Building: <u>219</u>
Unit No. P-1D Location BASEMENT MECHEM Area Served TURE TEMPERATURE UNITED POMP
Motor:  Horespower Phase 3 Hertz 60  Volts 238/466 Amps 14.4/7.2 RPM 1745
Manufacturer
None Variable Frequency Drive  Motor Starter HOA Switch  Remarks:

Project Name: FT GOLVOIR ENS STUDY Project Number: 60692, ao
Building: 219
Unit No. P2 Location BREMENT MEM Area Served STEAM CONDENSATE Pure
Motor:  Horespower 3/4 (Z)  Phase Hertz  RPM
Manufacturer
Controls:  None Variable Frequency Drive  Motor Starter HOA Switch
Remarks:

**BUILDING 247** 

## Boiler Survey Data Sheet

	AS Study		
	ntion BASEMEN	T MECH AreaServed_	
Cast Iron		Hot Water X	
turer	WELL	MCLAN	
			Cl 170
Gas 😾		Input 4474 MBH Input 3 Gal/Hr	
Model	UB2C-30-	R7795C LL, 25	STRIAL WOLFIGES-
:		Automatic Feedwater Va Make-up Water	live
:	CAST		
· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	
	Cast Iron Local Cast Iron Loca	Location BASEMEN  Cast Iron A teel MBH  Input Rating MBH  Iter Rating MBH  Curer WEIL  Manufacturer WEIL  Model VB2C-30-  None Low Water Cut-off A	Location   BREMENT   MEZH   AreaServed

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## Boiler Survey Data Sheet

Project Name: Ft Belvoir EMS Study Project Number: 60692.00	57 AND - 64
Building: <u>247</u>	NT MECH AreaServed
Unit No. 3-2 Location BREME	OM Areaserved
Type: Cast Iron Steel	Hot Water Steam
Capacity:  Input Rating MBH  Net Rating MBH	
Manufacturer WB/L-M	CLAIN
Model	
Burner: Gas Oil	Input 4474 MBH Input 31 Gal/Hr
Manufacturer WEBSTER  Model JB2C-30-R7	795C-U.25 SERVE WO19685-3
Controls:  None Low Water Cut-off X	Automatic Feedwater Valve Make-up Water PRV
Remarks:	
-	

#### Chiller Survey Data Sheet

Project Name:	· · · · · · · · · · · · · · · · · · ·
Project Number: Building:	
	Area Served
Compressors:  Reciprocating Centrifugal Rotary	Number Horespower FLA
Condenser Type:  Air Cooled Packaged  Air Cooled Split (Condensing Unit)	Air Cooled Remote (Condenser\) Water Cooled (Cooling Tower)
Electrical: Volts 460 FLA	Phase 3
Manufacturer YOKN Model YT B2	C3 CI- CKP
Controls:  None HOA Switch	Motor Starter X WESTIN 6 HOUSE
Remarks: R-1] M	CA 314 MOCP 600
COMPRESSUR GORIAL NO. Y	YDTS-85 CORE KY CTM - 083252
	1 4/20 - 30 - 60 10 2
202 APT	1 4/32 - 24 - 10 = 2
NOMINAL 300 ,66-	71
2-Press 213 0 -4°	f LERING
950 Extensions	-

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#### Cooling Tower Survey Data Sheet

Project Number: 60692.00	MS STUDY
Building: <u>24</u> 7	
Unit No. <u>C7-1</u> Location <u>OV7510+ 6</u>	Note that Area Served C-1
Configuration: \/	
Draw Thru X Blow Thru	Standard Height
	20 W Similatette
Motor: High Speed:	
Horespower 15 Phase 2	Volts Zoo Amps 44, 8
Hertz 66	RPM 1765
Low Speed:	
Horespower	Volts
Phase Hertz	Amps RPM
Manufacturer MARLEY	
Model	1 0800 1 229.00
Controls: SECIA	+ 8908 6-379-85
	ariable Frequency Drive
Motor Starter T	wo Speed Motor
Remarks:	
	·

#### Air Cooled Condensing Unit Survey Data Sheet

Project Name:	BELVOIR EMS	STUDY		
Building: 247	_	;		÷:
Unit No. ACCV Loca	ation <u>PENTHOUSE ME</u> KOOM	Area Served _	AUDITECIUM	AHU
Compressors:  Reciprocating  Rotary	; <u>X</u>	Numb Hores FLA	per <u> </u> ppower <u> 60</u> 	/
Fans: Number RPM		Horse	power	
Electrical:  Volts FLA	ofyyo 2/71 Ourwine An-	Phase Hertz	3	
Manufacturer	CHLYNDE ARE	PART +	M 1423686	
Controls:  None HOA Switch		Motor Starter X	POMBILIATI	EN DS/MS
Remarks: W/	REMOTE CONCERN	eer ha-		
	UNIT 15 DISC	ONNECTED IS DEEN	them DX	101C
	CONTROLS HP	VE CEEN	DISTELED	)

#### Air Cooled Condenser Survey Data Sheet

Project Name: FT BELVOIR EMS STUDY Project Number: 60698,00	<u>,                                     </u>
Building: <u>24</u> 7	
Unit No. ACC   Location ROOF	Area Served AGOTTUKIUM (ACCO-1)
Fans: Number / RPM	Horsepower
Electrical:  Volts 460  FLA 11  Manufacturer  Volts 460  MANUFACTURE	Phase $\frac{7}{66}$ Hertz
Model	
Controls: None Moto HOA Switch	Fig. 11. 1856 60902 r Starter
Remarks:	

Project Number: 60692	LVOIR EMS STUDY
Unit No. AHU Location	Area Served AUDITORIUM
Air Type: Constant Volume	Variable Volume
Zone Type: Single Zone	Multi-Zone
Cooling: Chilled Water None	DX _X
Heating:  Hot Water  Electric	Steam None
Supply Fan: Forward Curved Backward Incline Airfoil	
nfiguration: Blow-Thru Draw-Thru	Horizontal Vertical
Motor Horespower 10 Phase 3 Hertz 60	Volts <u>208</u> Amps <u>30</u> RRM 1750
ManufacturerModel	PIEU BUIT-UP
Return Air Fan: Fan No	None _\
Economizer Controls:  None Outdoor Enthalpy Drybulb Comparison	Outdoor Drybulb Enthalpy Comparison
Remarks:	PARELMATIC 3-WAY CONTINC FROM THE HOTE WATER
	PAJELMATIC DAMPER ACTUATOR FOR RETURN DA.
	ROBERGYEN RELEIVER CONTROLLER (BOLING
	JOHNSON CONTROLS T-8000 - PROP ACTING 7.5-47
	RUPERT BUMON GRACHER GUITCH AND RUGGILLE ROBUSTIC
	The Louis as to have the second of the secon

Project Name: FT BEUDIR EMS ST Project Number: 60692.00	<u>voy</u>
ilding: <u>24</u> 7	
Unit No. AHV-1BLocation	Area Served
Air Type: Constant Volume	Variable Volume
Zone Type: Single Zone	Multi-Zone
Cooling: Chilled Water None	DX
Heating:  Hot Water  Electric	Steam None
Supply Fan: Forward Curved Backward Incline Airfoil	Controls: Inlet Vanes Variable Frequency Drive Motor Starter HOA Switch
nfiguration: Blow-Thru Draw-Thru	Horizontal / Vertical
Motor  Horespower  Phase  Hertz	Volts Amps
Manufacturer KANE Model HAN HELLON MCCA OOBCHE	
Return Air Fan: Fan No	None
Economizer Controls:  None Outdoor Enthalpy Drybulb Comparison	Outdoor Drybulb Enthalpy Comparison
Remarks: ()091.001 00	TROCS ELECTRIC STANT HOT WATER LAWS
*LECKIO	OUTHIR PR DAMPER ACTUATOR
JAANGE OVER ADVASTAT	AL COILS HOTE CHILLSO
JOHNSON TIME CLOCK	A-5% SALES ENG. SOG TYPE TO

#### Fan Coil Unit Survey Data Sheet

Project Name: TT BELYDIR EMS STUDY Project Number: 60692.00
Building: 247
Unit No. FC-   Location Area Served
Cooling: Chilled Water  None
Heating:  Hot Water   Steam  Electric KW  None
Fan Motor         Horespower         Volts           Phase         Amps           Hertz         RPM
Electrical:  Volts
Manufacturer_ NTERNATIONAL ENVIRONMENTAL CONF.  Model_
Controls:  Self Contained Remote Outside Air
Remarks: Z WAY ELECTRIC CONTROL VARVE
Z- PIPE HEATING/COOLING

Project Name: TT BELYDIR EMS STUDY Project Number: 60692, 60
Building: <u>24</u> 7
Unit No. Location BESIMENT MECH Area Served HEATTAGE FOMP
Motor:  Horespower 7.5  Phase 3  Hertz 600  Manufacturer 411000 Fig. 12369-2 7465 361 67  Str. 2.5 v.9
Manufacturer #1KUKA TUWE Model
Model 76-12369-2 748 361 65 362 2.5 49
Controls:  None Variable Frequency Drive  Motor Starter HOA Switch
Remarks: WRE PUNTER
JOHNHON LONTROLS T-5800-3 PROFIT RECEIVER COM
160 GFM
750 RPM

Project Name: FT BEWOIR EMS STUDY Project Number: 60092,00
Building: <u>24</u> 7
Unit No. PL Location BASEMENT MECH Area Served HEATING PUMP
Motor:  Horespower 7.5  Phase 3  Hertz 6  RPM 1743
ManufacturerAVCORA
Model 91-09175 761A-61
Controls: 5138 2,5 x 3 x 9
None Variable Frequency Drive Motor Starter HOA Switch
Remarks: W/P.E. Source

Project Name: Project Number:	
	EMENT MEHLAM Area Served HEATTING WATER PLANT
Motor:  Horespower 5  Phase Hertz	Volts <u>208/230 - 460</u> Amps <u>15.2/14.4 - 7.2</u> RPM <u>1150</u>
Manufacturer	70 FM5010 8,3 BZG101 LO
Controls:  None Motor Starter	Variable Frequency Drive HOA Switch
Remarks:	WI REMOTE BULB T-57413 FOR O.A.
	Aire MOUNTED END FULTION CENTRIFUCAL

MR SOM	CIEC	Xin Str.
ŕ	_ #	in the Steam
		()

Project Name:Project Number:		*	
Building:		,	ind S
Unit No Location	Area Served	HUT WATER	Than En
Motor:  Horespower Phase 1 Hertz (L)	Volts (5 Amps		
Manufacturer	INCINE CIRCO	LATOX	5/89
	Variable Frequency Drive HOA Switch	<del></del>	
Remarks:			
			W. 40-91-2-10-10-2-1-1-1-1-1-1-1-1-1-1-1-1-1-1-

Pump	Data	Survey	Shee
I WILL	~ ~~~	- u ,	01100

PLAT

Project Name: Project Numbe	FT BELVON	R EMS STUDY			
Building: 24	17				
Unit No. <u> </u>	Location FASE	MENT MECH ROOM	Area Served _	CHULD O	WATER FUMF
Motor: Hores Phase Hertz	power 10	Volts Amps RPM	208 28 1740		
Manufacturer Model	7 (-5)	194-2	7983	GBPA 445×9B	-6F
Controls: None Motor	StarterX		ency Drive		
Remarks:					
	V				
			34.54		
	77.7.334		10-900-1		
			de la companya de la		

Project Name: FT BEZVOIR EMS STVDY Project Number: 60672.00
Building: 247
Building: 247 Unit No. P. 6 Location BASEMENT MECH Area Served CONTRAFER WATER FUNDS.  ROOM  Area Served CONTRAFER WATER FUNDS.
Motor:  Horespower $\frac{16}{Phase}$ Phase $\frac{3}{Phase}$ Hertz $\frac{1}{16}$ RPM $\frac{175}{Phase}$
Manufacturer Aukukk
Manufacturer 10 KULK  Model 967-12745 - 798 6644-65  Controls:  None Wariable Frequency Drive HOA Switch
Remarks: 702 6Pm 37.5 FT

Project Name: FT BELLOK EN Project Number: 60692, 60	15 STUDY
Building: <u>24</u> 7	
Unit No Location BASEMEN KO	OM Area Served Covie See WATER
Motor:  Horespower	Volts 27.4 /13.7 RPM
Manufacturer #VLOX A Model #88	-5918 7418 344A -SF
Controls:  None Motor Starter	Variable Frequency Drive HOA Switch
Remarks:	702 6PM 37,5FT
	1160 RM

**BUILDING 1425** 

#### Chiller Survey Data Sheet

Project Name: TI DELYOIR EMS STUDY Project Number: 60692,00	
Building: 1425	
Unit No. 61 Location OUTSIDE EAST Area Se	erved
Compressors:  Reciprocating Centrifugal Rotary Rotary	Number 3 Horespower  RLA 34 1 LLA 24 7
Condenser Type:  Air Cooled Packaged  Air Cooled Split (Condensing Unit)	Air Cooled Remote (Condenser) Water Cooled (Cooling Tower)
Electrical:  Volts ZOO  FLA  MCA  Pl	Phase 3 Hertz 60
Manufacturer TCANE Model CGADCHOGAF A 16 TUR	/xxin J92H33099
Controls:  None Motor Starter _  HOA Switch	
Remarks:	

#### Fan Coil Unit Survey Data Sheet

Project Number: 606	PLVOIR BMS STUDY	
Building: <u>1425</u>		
Unit No. Fcv-1 Location	Area Served	
Cooling: Chilled Water None Heating: Hot Water Steam Electric None	20116	
Fan Motor  Horespower  Phase  Hertz	Volts Amps RPM	
Electrical:  Volts  Hertz	Phase FLA	
ManufacturerModel	TRANIE	
Controls:  Self Contained  Outside Air	Remote	
Remarks:	3- WAS STRUCK CONTROL VALVE	
-		
-		

#### Fan Data Sheet

Project Name: TOELVOIR ENS ST. Project Number: 60692,00	<del>764</del>
Building: 1425	
Unit No. EF-1 Location RODF	Area Served RESTROOM SUMMIST
Fan Type:  Power Roof Ventilator  Utility Fan  Inline Centrifugal  Ceiling Centrifugal	Forward Curved Backward Incline Airfoil
Motor:  Horespower Phase Hertz	Volts Amps RPM
Manufacturer	
Controls: None Mo	otor Starter riable Frequency Drive
Remarks:	

Project Name: F7 BELVOIR EMS STUDY Project Number: 60692.00
Building: <u>142</u> 5
Unit No. P   Location BASEMENT MEAN Area Served CHILLED HEATING WATER
Motor:  Horespower 5  Phase 7  Hertz 60  Motor:  Volts 208/250-460  Amps 13.8-13.2/6.4  RPM 1746
Manufacturer MARKET AMTROL / THRUSH PUMOS  Model 1/4 × 1/2 × 988 SERIES 2500
Variable Frequency Drive  Motor Starter HOA Switch
Remarks: 1956PM @ 75 Fy Hem

A-70

Project Name: FT BE Project Number: 60672	ELVOIR EMS STUDY	p.	ij
Building: <u>142</u> 5			
Unit No. <u>F-2</u> Location _	FORENEST MECH	Area Served CHIUED / HE	EATING WATER
Motor:			
Horespower	Volts _	Mark Conference	
Phase	Amps		
Hertz	RPM _		
Manufacturer			
Model			
Controls:			
None	Variable Freque	ency Drive	
Motor Starter		•	
Remarks:			
			and the little and the second and th
			<u> </u>
•			

SAME to Run P-1

**BUILDING 3136** 

#### Chiller Survey Data Sheet

Project Name: FT BELVOIR EMS STUDY Project Number: 60692.00	·
Building: 3136	
	Area Served
Compressors:  Reciprocating X Centrifugal Rotary  Condenser Type: Air Cooled Packaged	Number 2 Horespower 1 LRA 394 KA 72 2 Air Cooled Remote (Condenser)
Air Cooled Split (Condensing Unit)	Water Cooled(Cooling Tower)
Electrical:  Volts 200  FLA  M(A 179  Manufacturer  Manufacturer	Phase Hertz
	CC406 KWEE 4236
Controls:	J8 8A 6069
None Motor St HOA Switch	arter
Remarks: U Compression	FASS 4,1 FDA EACH
	HORSE POWER
***************************************	
ON PONK PROMERATIONS  STORY TELLS, ONT	AND THEKMOSTEM, SENSING THE MESH FROM THE MESH CHIPMICES ONEM

#### Fan Coil Unit Survey Data Sheet

# # # # # # # # # # # # # # # # # # #
Area Served
2 PIRE
Volts Amps PM
rhase TLA
Remote
CONTROL VALVES
NGE HOT WATER IS ALWAYS

A-74

Project Name: FI BELYOIR EMS STUDY Project Number: 60092,00
Building: 31-24
Unit No. PI Location FATIMENT MECH Area Served CHILLED HEATING WATER
Motor:  Horespower $5$ Phase $3$ Hertz $60$ Notes $2006 + 230/460$ RPM $3(50)$ RPM $3(50)$
Manufacturer
Controls:  None Variable Frequency Drive  Motor Starter HOA Switch
Remarks:

# APPENDIX B MECHANICAL EQUIPMENT LOCATION PLANS

**BUILDING 200** 

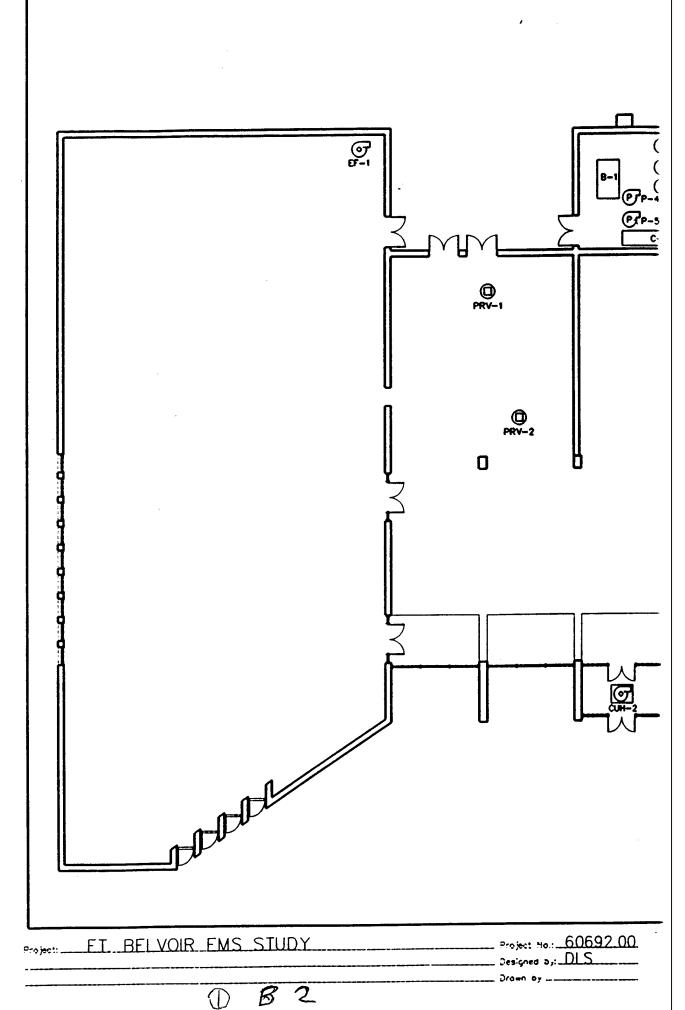
# Einhorn Yaffee Prescott

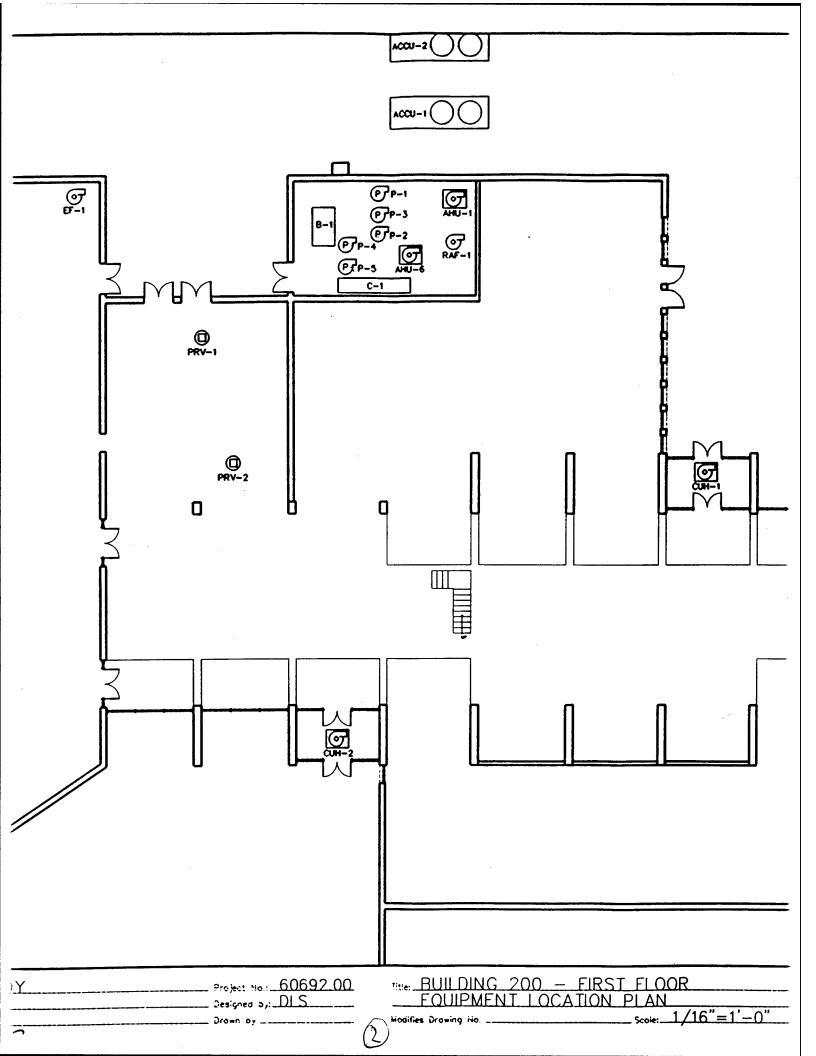


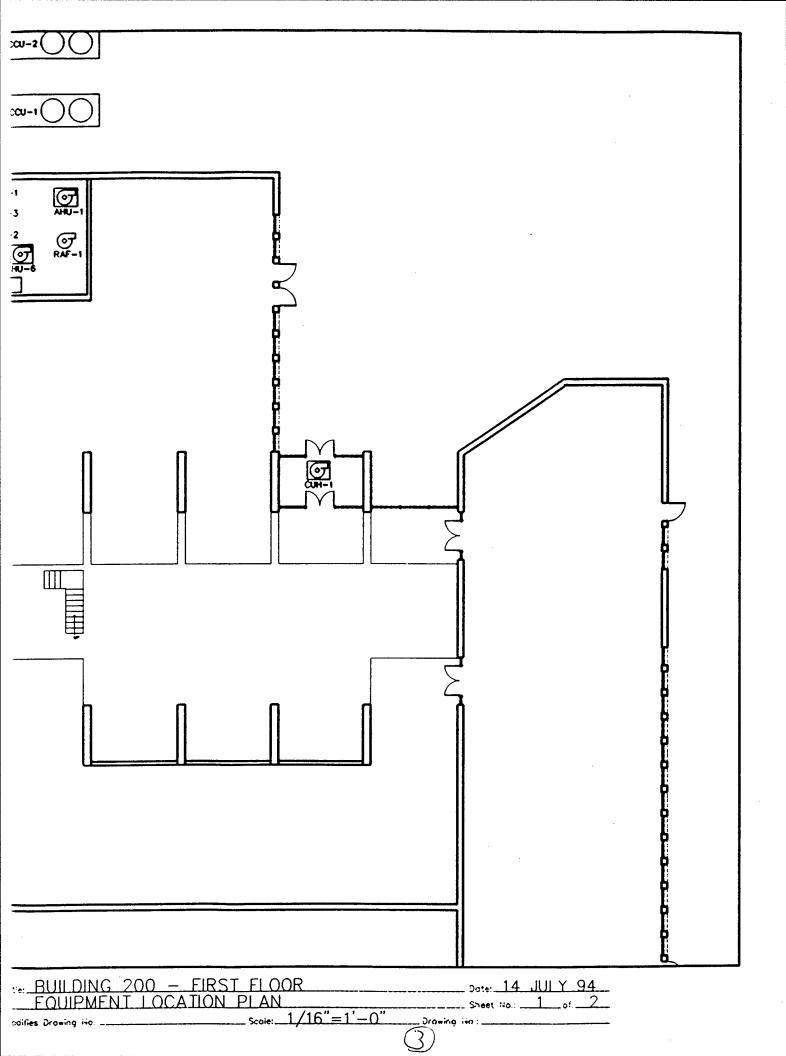
ARCHITECTURE & ENGINEERING, P.C.

THE ARGUS BULLONG
BROADWAY AT BEAVER
POST OFFICE BOX 617
ALBANY, NY 12201-0617
TEL (518) 463-2141

THE FLOUR MILL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 TEL (202) 471-5000







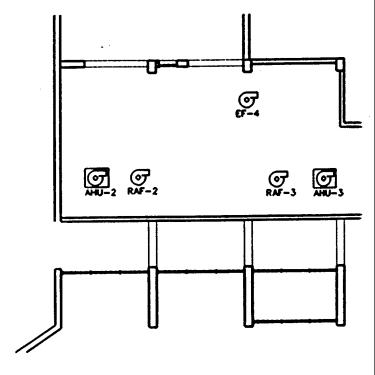
# Einhorn Yaffee Prescott



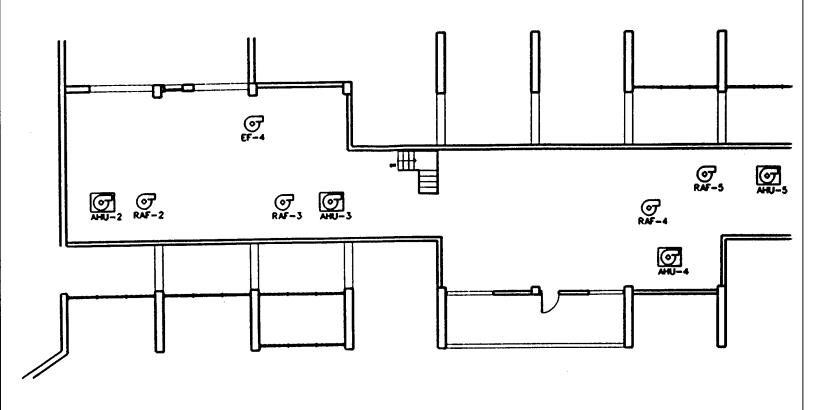
ARCHITECTURE & ENGINEERING, P.C.

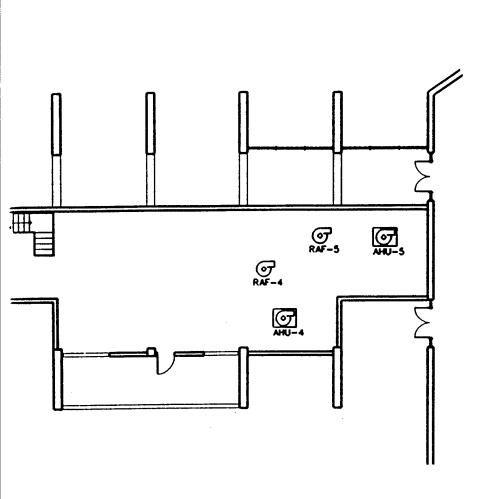
THE ARGUS BUILDING BROADWAY AT BEAVER POST OFFICE BOX 617 ALBANY, NY 12201-0617 REL (518) 463-2141

THE FLOUR MILL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 TEL (202) 471-5000



Project: FT. BELVOIR EMS STUDY	Project No - 60692.00
	Designed by:
<i>B</i> 3 ~ ①	





| BUIL DING 200 - MEZANINE | Date: 14 JULY 94 | | FQUIPMENT LOCATION PLAN | Sheet 140: 2 of: 2 | Modifies Drowing 190: | Scole 1/16"=1'-0" Drowing 190: | Dr

3

**BUILDING 219** 

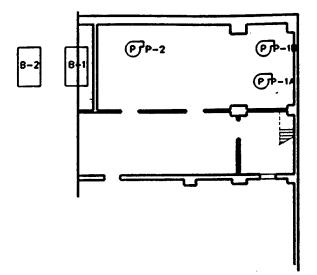
# Einhorn Yaffee Prescott

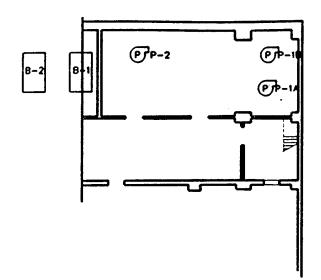


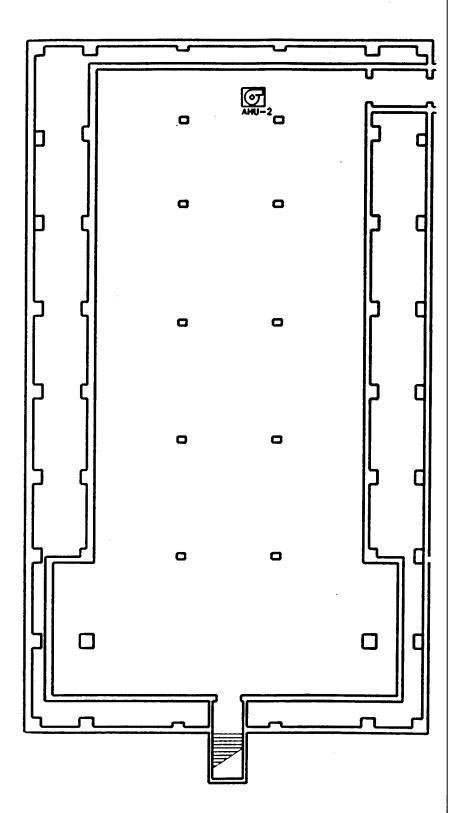
ARCHITECTURE & ENGINEERING, P.C.

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THE FLOUR MILL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 TEL. (202) 471-5000

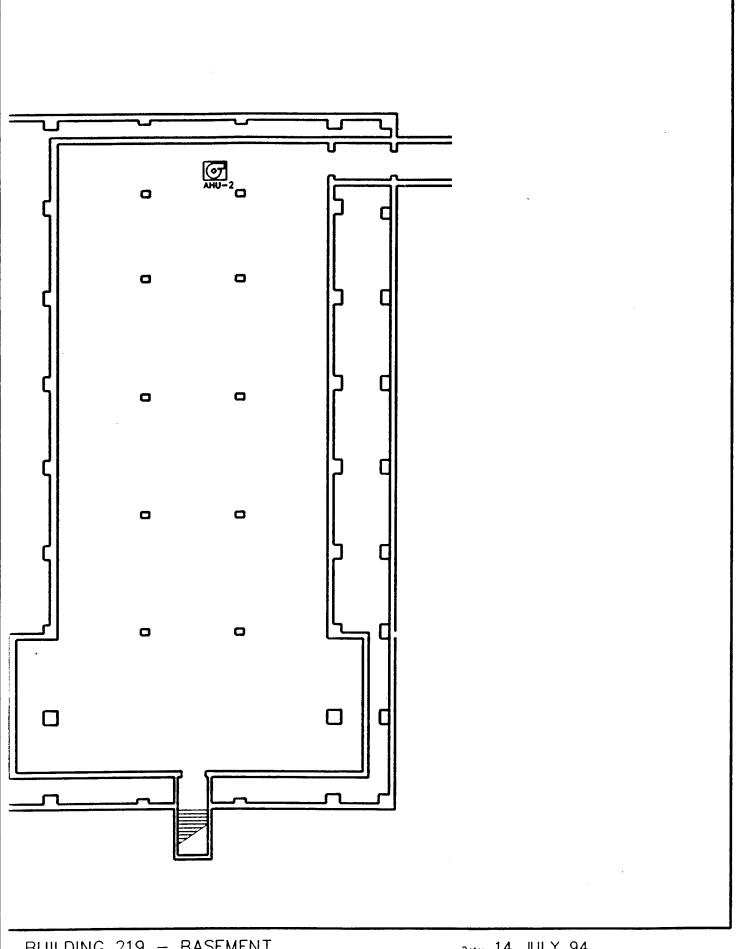






Project No.: 60692.00.

BUILDING 219 - BASEMENT FQUIPMENT LOCATION PLAN



BUILDING 219 — BASEMENT Socie: 14 JULY 94

FOUIPMENT LOCATION PLAN Sheet No.: 1 of 3

Diffies Drawing No. Socie: 1/16"=1'-0" Drawing No:

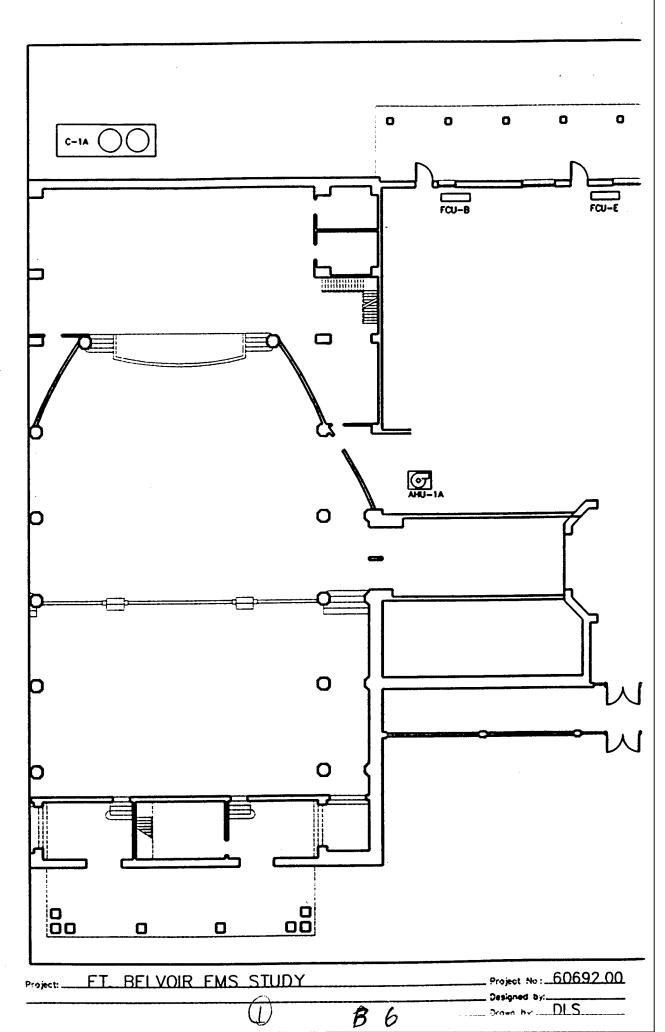
Einhorn Yaffee Prescott

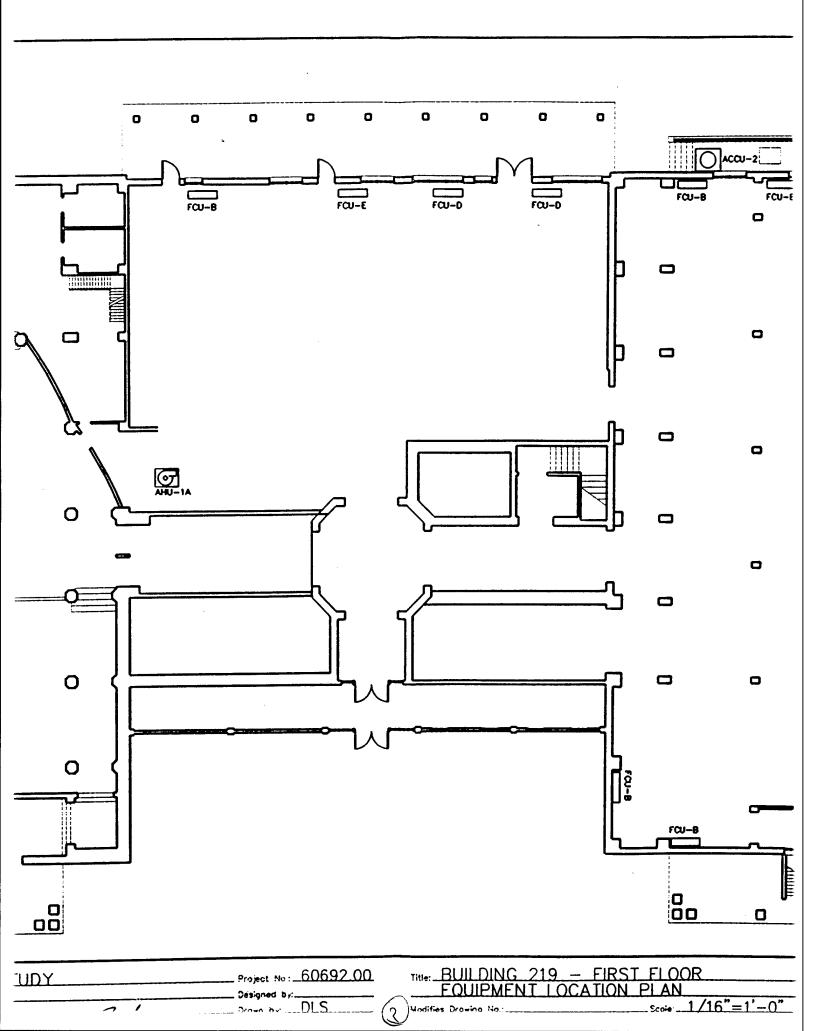


ARCHITECTURE & ENGINEERING, P.C.

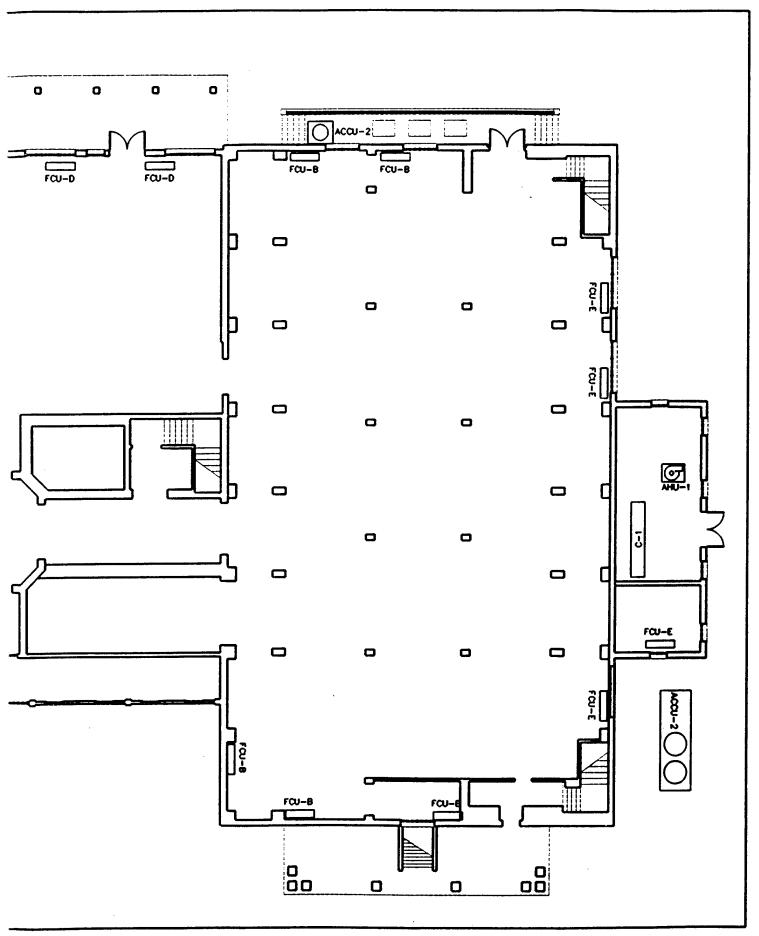
THE ARGUS BUILDING BROADWAY AT BEAVER POST OFFICE BOX 617 ALBANY, NY 12201-0617 TEL. (518) 463-2141

THE FLOUR MILL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 TEL. (202) 471-5000





make part of the second



Title: BUIL DING 219 — FIRST FLOOR

FQUIPMENT LOCATION PLAN

Scole 1/16"=1'-0" Drawing No:

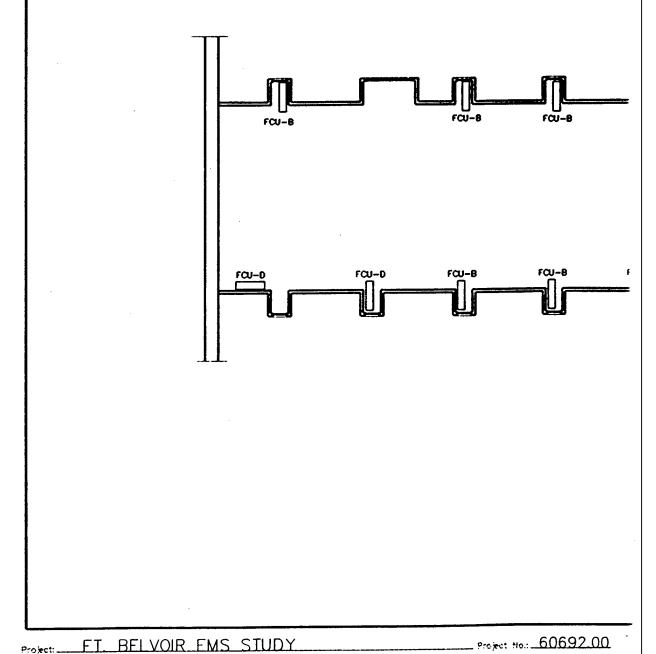
(3)

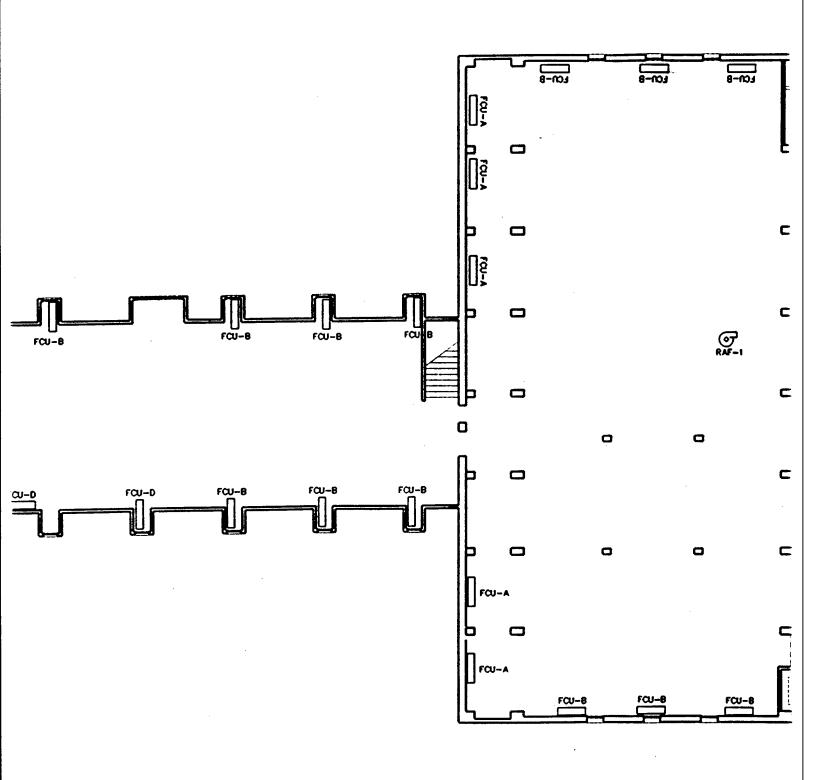


ARCHITECTURE & ENGINEERING, P.C.

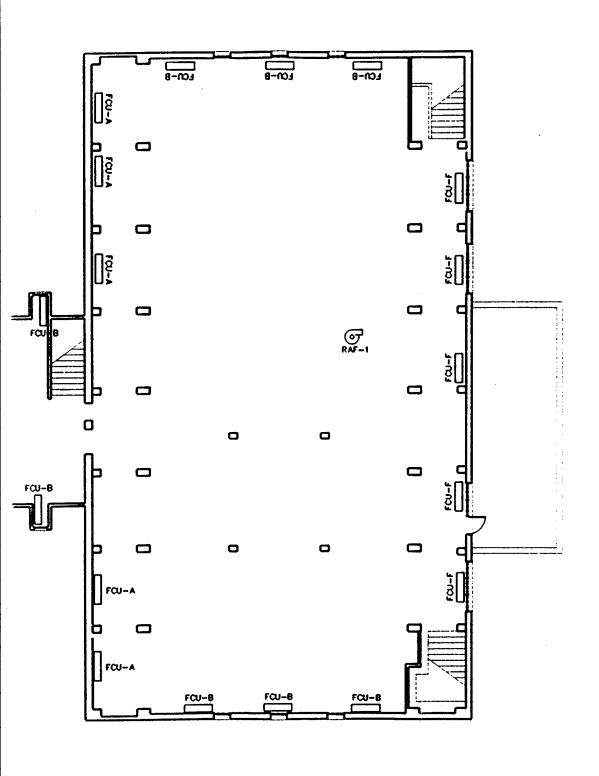
THE ARGUS BUILDING BROADWAY AT BEAVER POST OFFICE BOX 617 ALBANY, NY 12201-0617 TEL. (518) 463-2141

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STUDY	Project No.: 60692.00	Title: BUILDING 219 - SECONI	) FLOOR
<u> </u>	_ Designed by:	FOUIPMENT LOCATION PL	_AN
		Modifies Drawing No.:S	Scoie: $1/16"=1'-0"$
			•



Title: BUILDING 219 - SECOND FLOOR

FOUIPMENT LOCATION PLAN

Sheet No.: 3 of: 3

Modifies Drowing No.: Scoie: 1/16"=1'-0" Drowing No.: Sheet No.: 3 of: 3

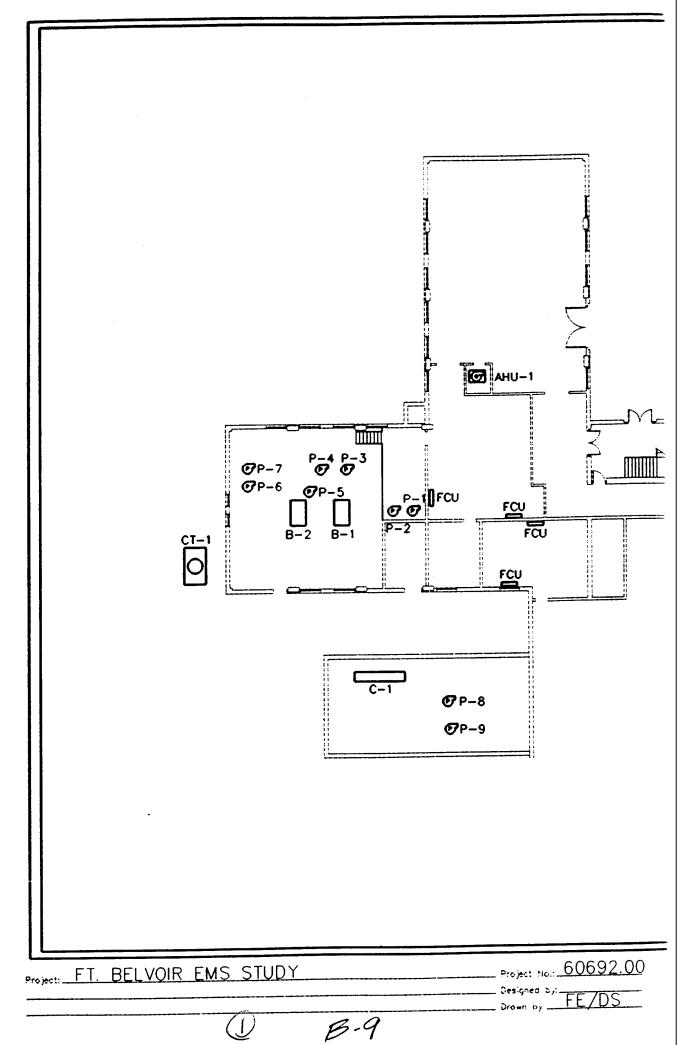
**BUILDING 247** 

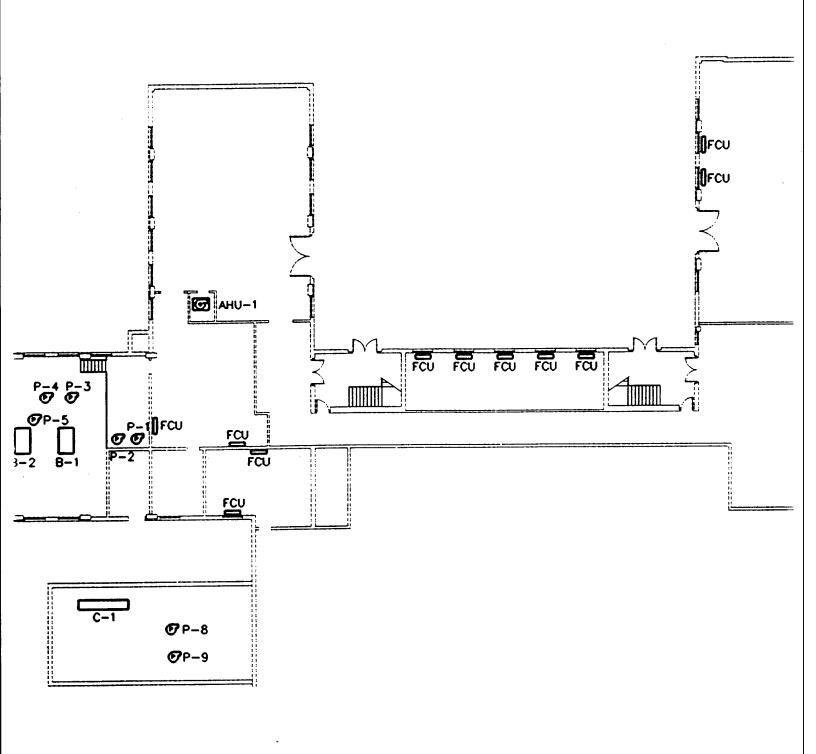


ARCHITECTURE & ENGNEERING, P.C.

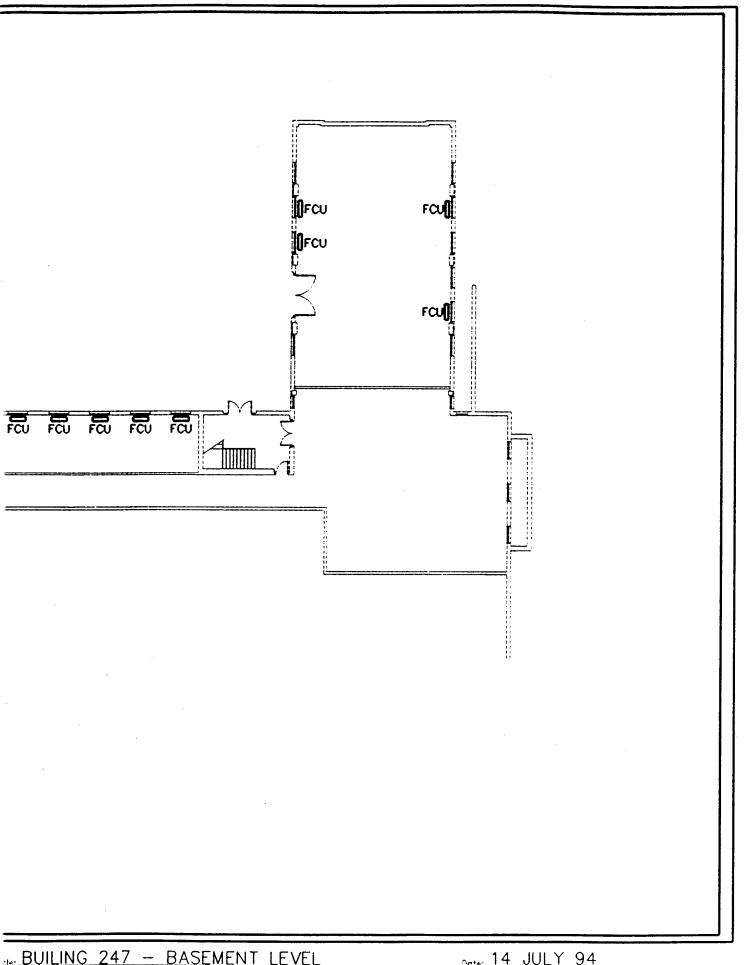
THE ARGUS BUILDING BROADWAY AT BEAVER POST OFFICE BOX 617 ALBANY, NY 12201-0617 TEL (518) 463-2141

THE FLOUR MILL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 TEL. (202) 471-5000





/	Project No.: 60692.00	BUILING 247	- BASEMENT LEVEL OCATION PLAN	
		EQUIPMENT L	OCATION PLAN	
	, , <u>F.E. /D.C.</u>	odifies Drowing No	Scole: NONE	
B-9				



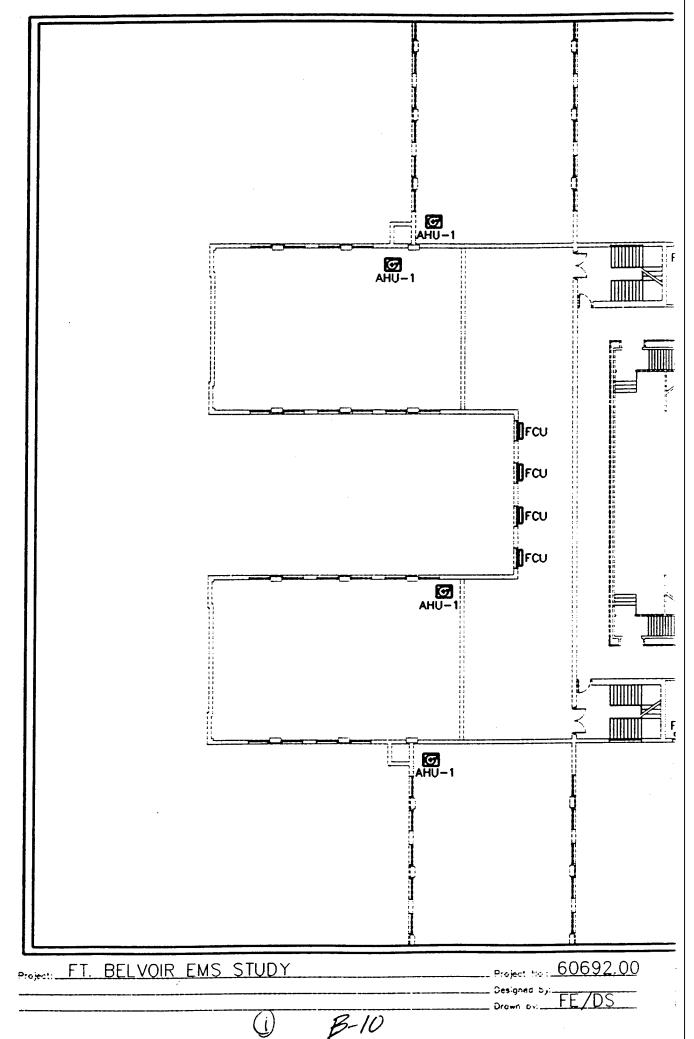
BUILING 247 - BASEMENT LEVEL	2014: 14 JULY 94
EQUIPMENT LOCATION PLAN	Sheet No.: 1 of 5
odifies Drawing NoScale: NONE	Drawing Iva.;
•	$\langle 2 \rangle$

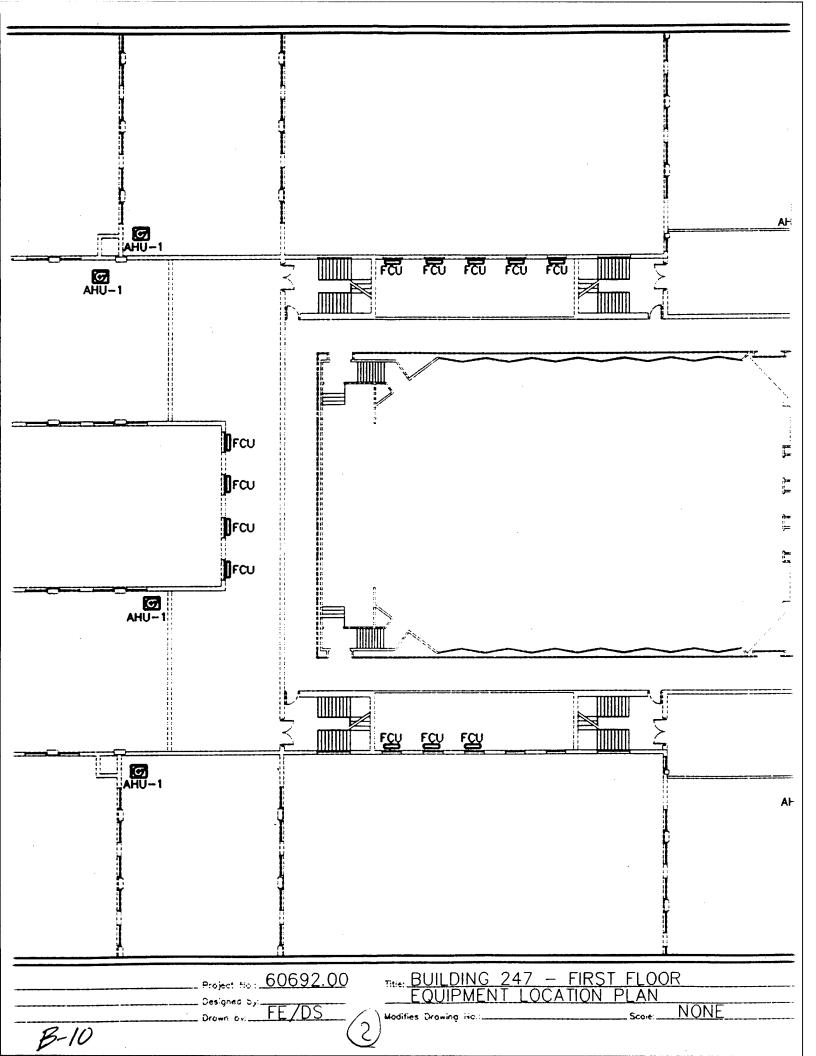


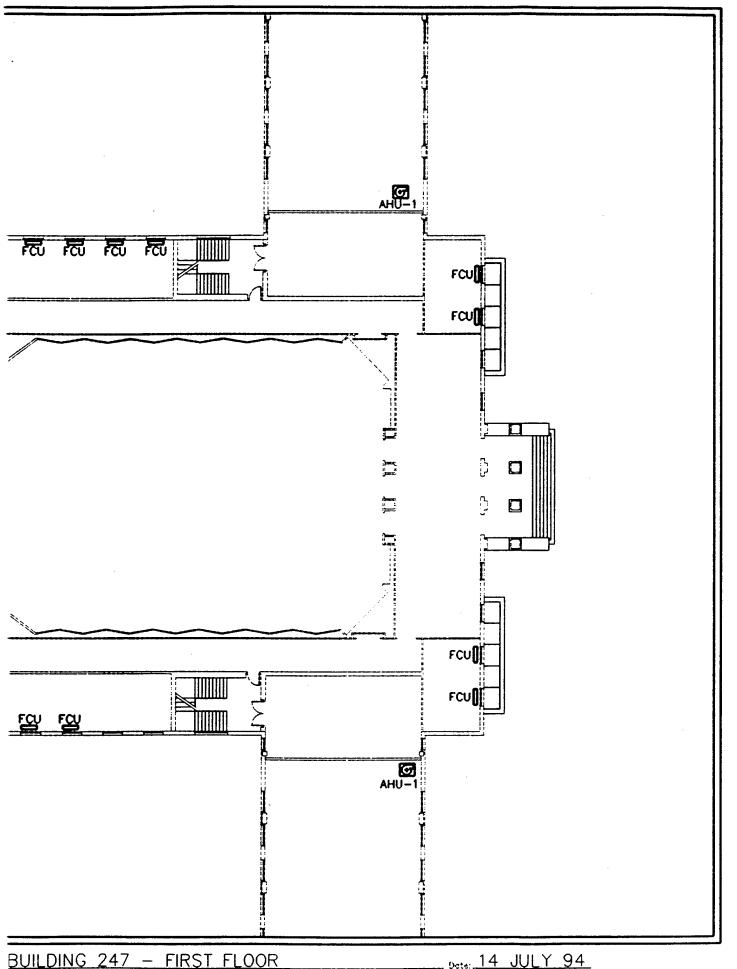
ARCHITECTURE & ENGINEERING, P.C.

THE ARGUS BUILDING BROADWAY AT BEAVER POST OFFICE BOX 617 ALBANY, NY 12201-0617 TEL. (518) 463-2141

THE FLOUR MELL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 TEL (202) 471-5000







BUILDING 247 - FIRST FLOOR

EQUIPMENT LOCATION PLAN

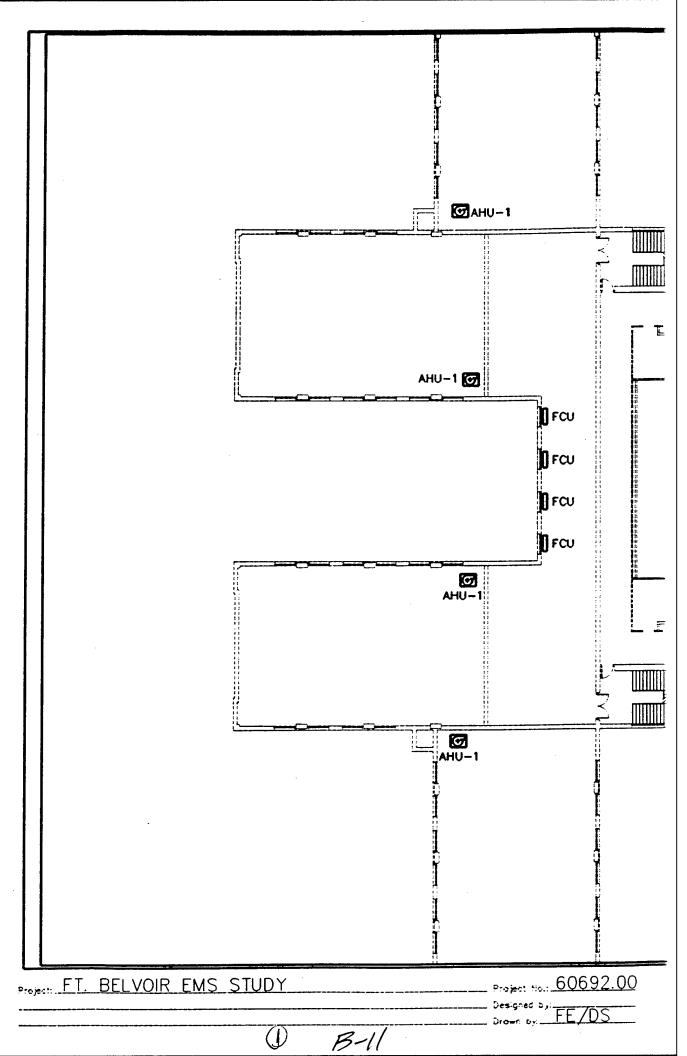
Sheet No.: 2 of: 5

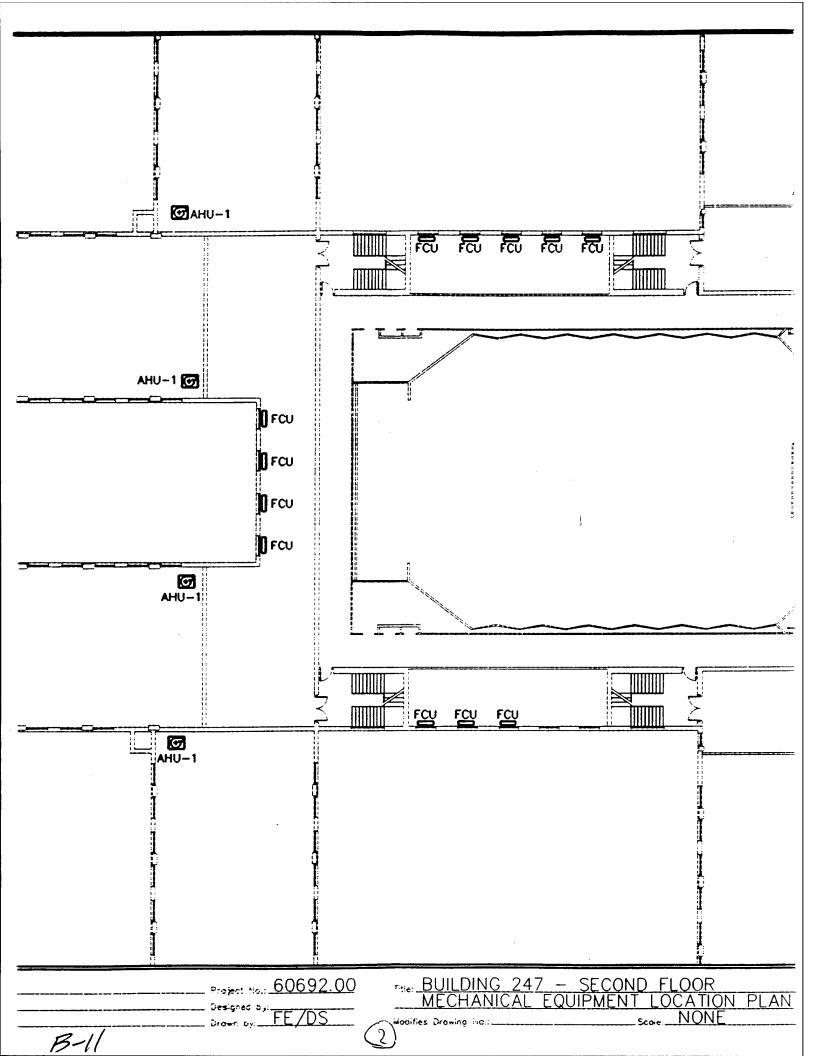
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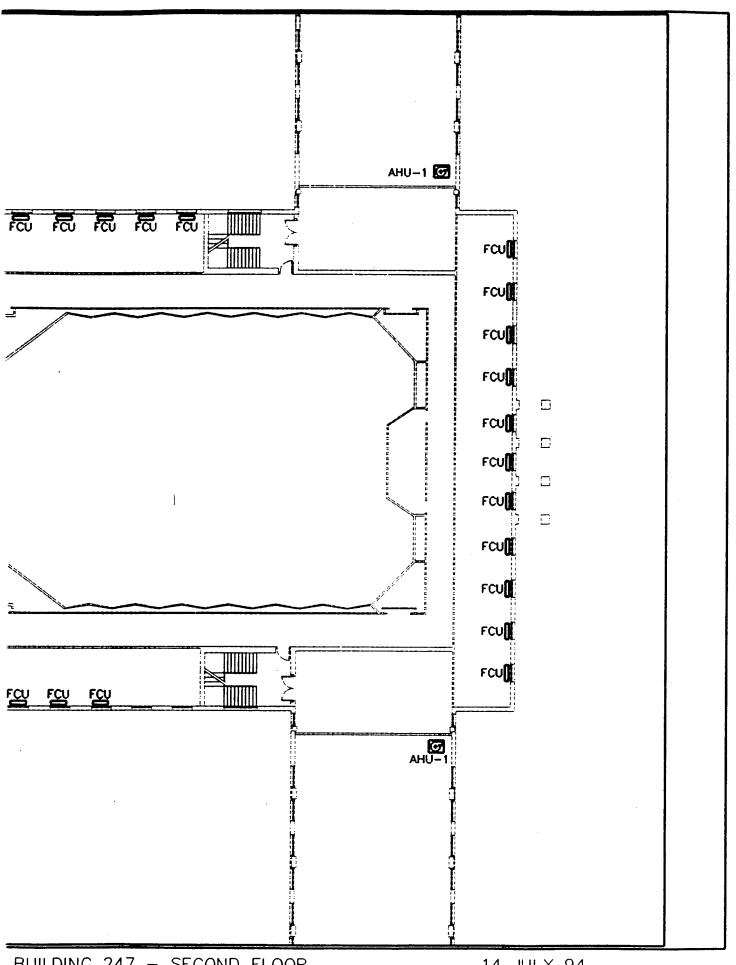


ARCHITECTURE & ENGINEERING, P.C. THE ARGUS BUILDING BROADWAY AT BEAVER POST OFFICE BOX 617 ALBANY, NY 12201-0617 TEL. (518) 463-2141

THE FLOUR MILL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 TEL (202) 471-5000







BUILDING 247 — SECOND FLOOR

MECHANICAL EQUIPMENT LOCATION PLAN

Seet 14 JULY 94

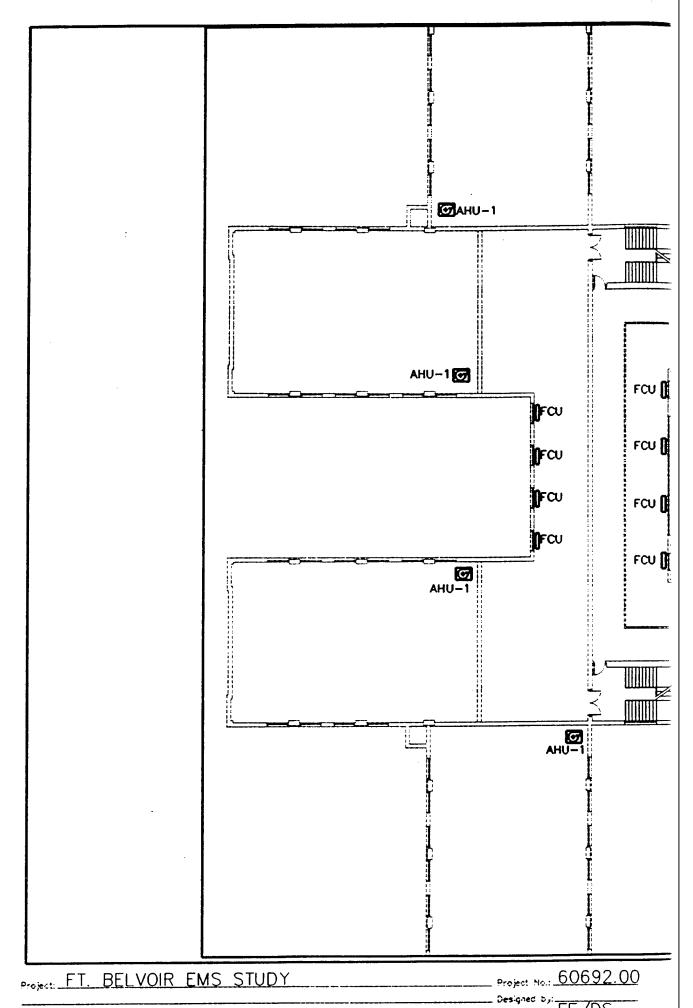
Sheet 16.: 3 of: 5



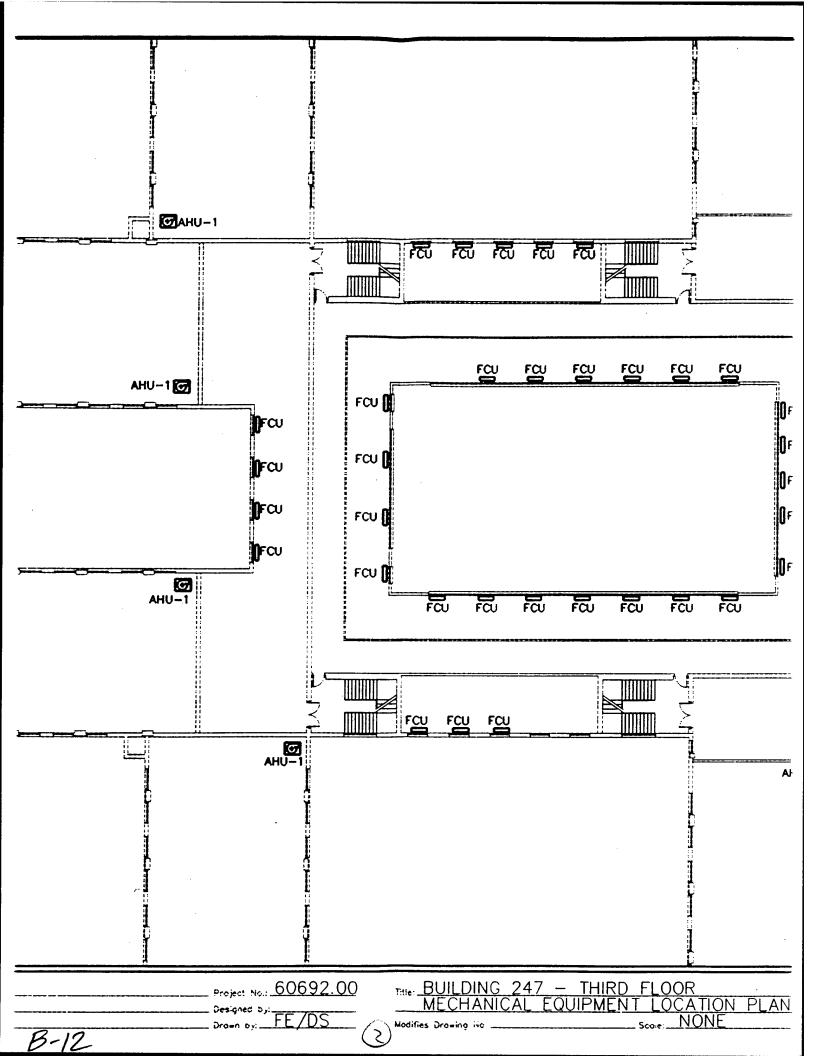
ARCHITECTURE & ENGINEERING, P.C.

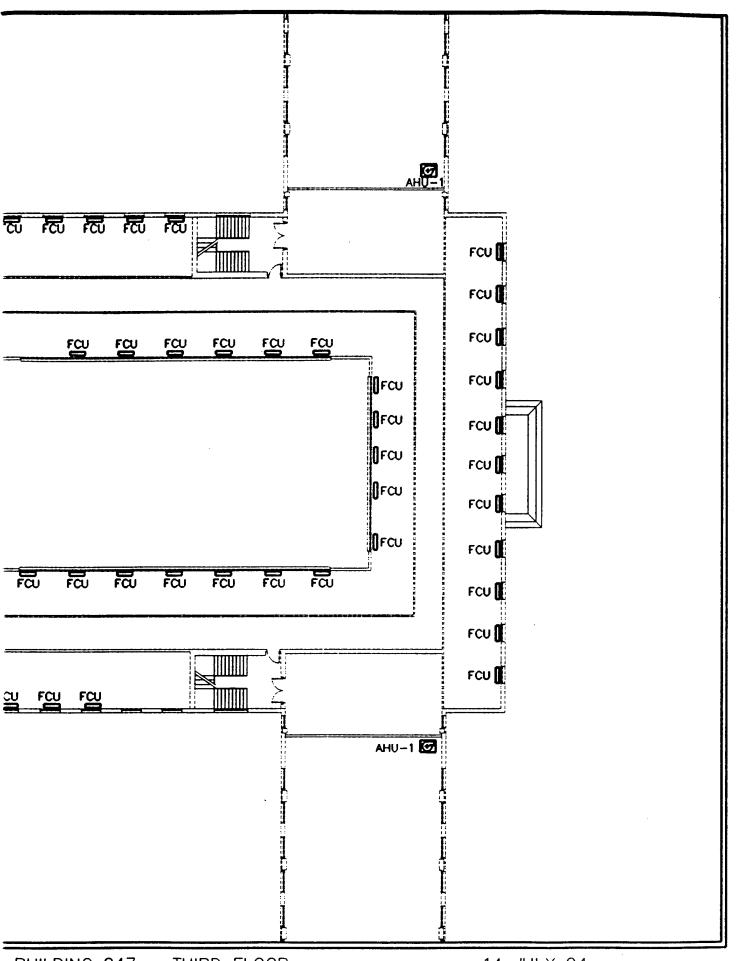
THE ARGUS BUILDING BROADWAY AT BEAVER POST OFFICE BOX 617 ALBANY, NY 12201-0617 TEL. (518) 463-2141

THE FLOUR MILL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 VEL. (202) 471-5000



B-12





BUILDING 247 — THIRD FLOOR

MECHANICAL EQUIPMENT LOCATION PLAN

Sheet No. 4 of 5

Growing No.:

Dote: 14 JULY 94

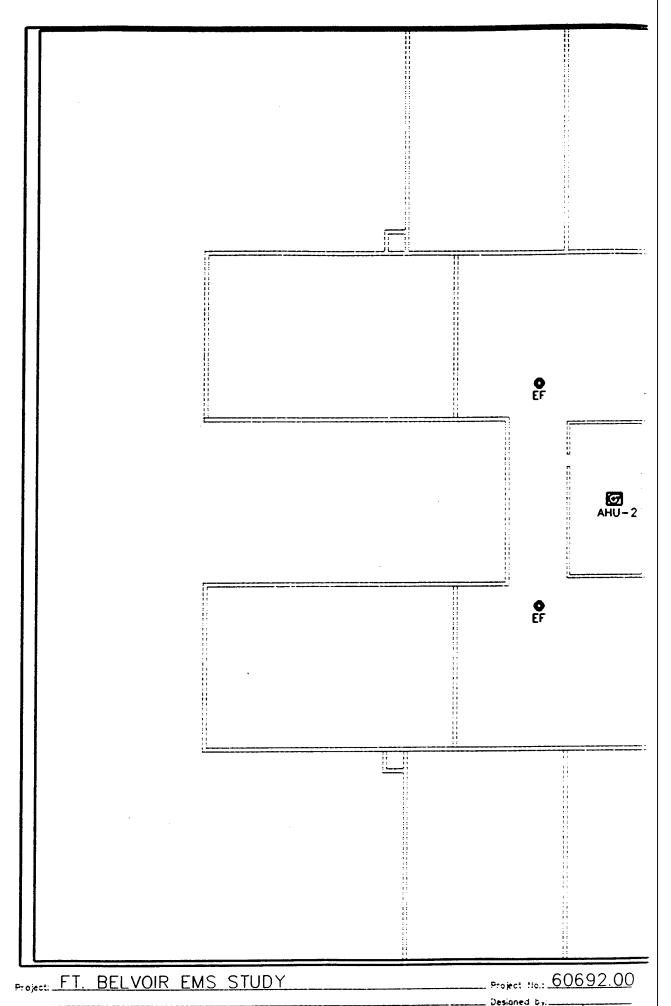
Sheet No. 4 of 5

(3

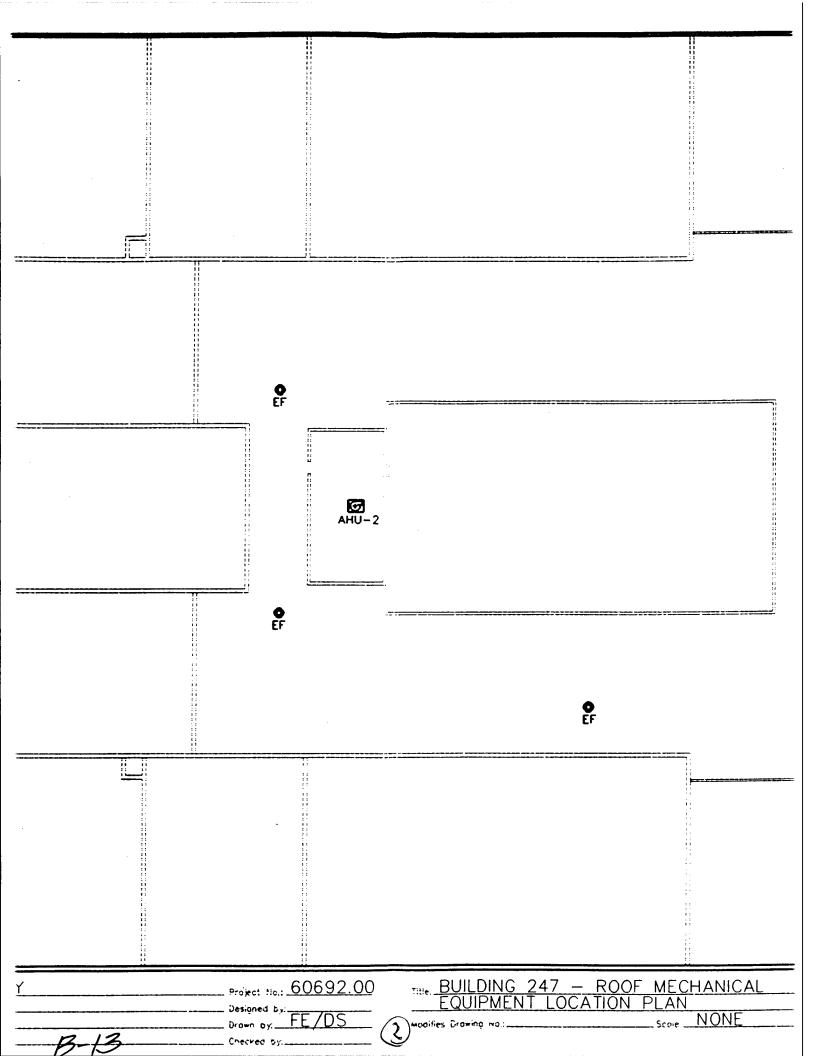


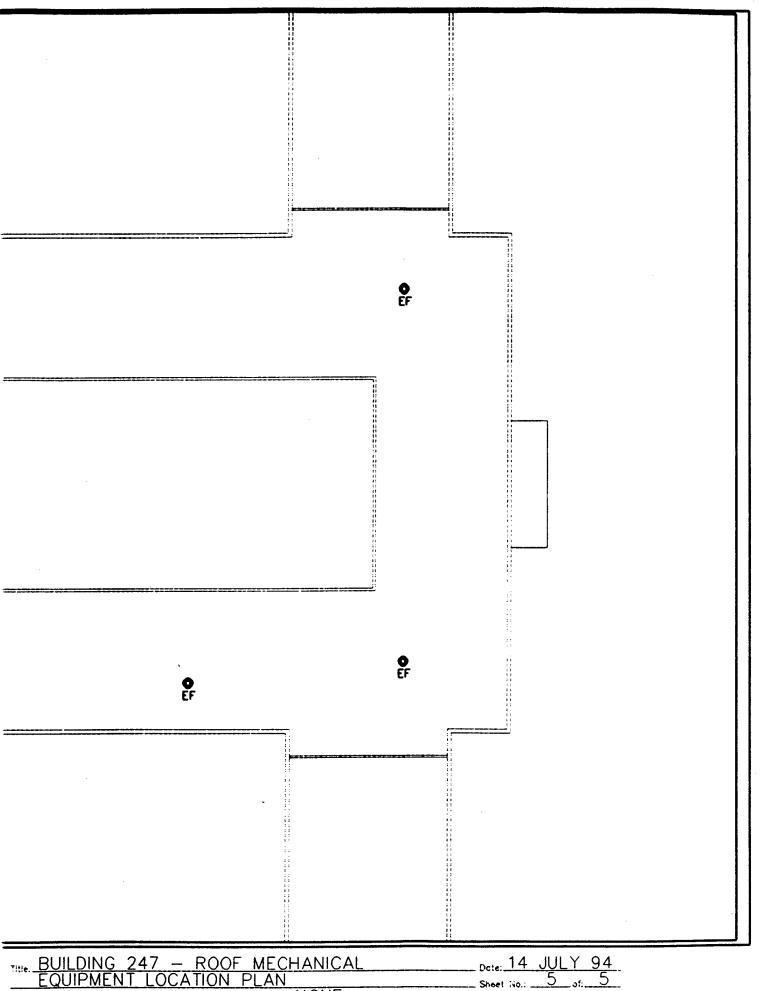
ARCHITECTURE & ENGINEERING, P.C. THE ARGUS BUILDING BROADWAY AT BEAVER POST OFFICE BOX 617 ALBANY, NY 12201-0617 TEL. (518) 463-2141

THE FLOUR MEL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 TEL (202) 471-5000









EQUIPMENT LOCATION PLAN

Sheet No.: 5 of: 5

Modifies Drawing No.: Scole NONE Drawing No.:

**BUILDING 1425** 

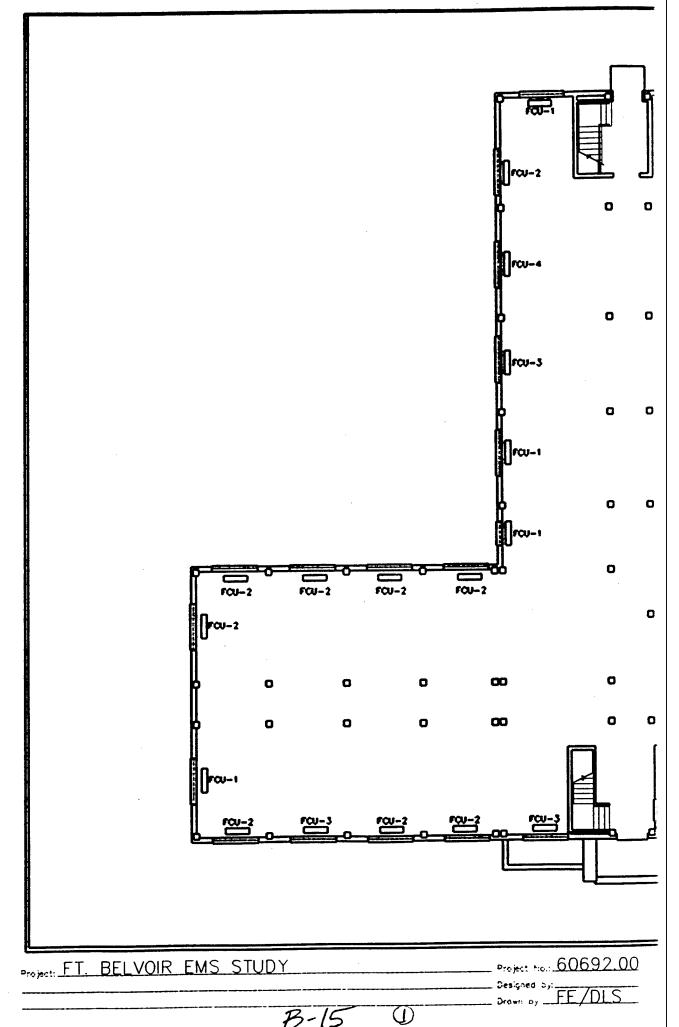
B-14

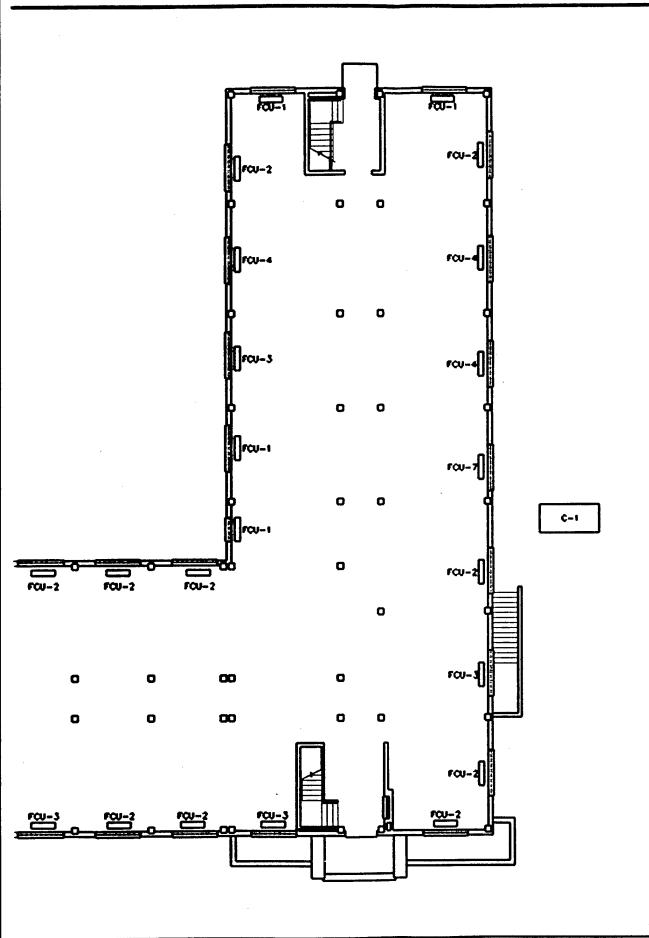


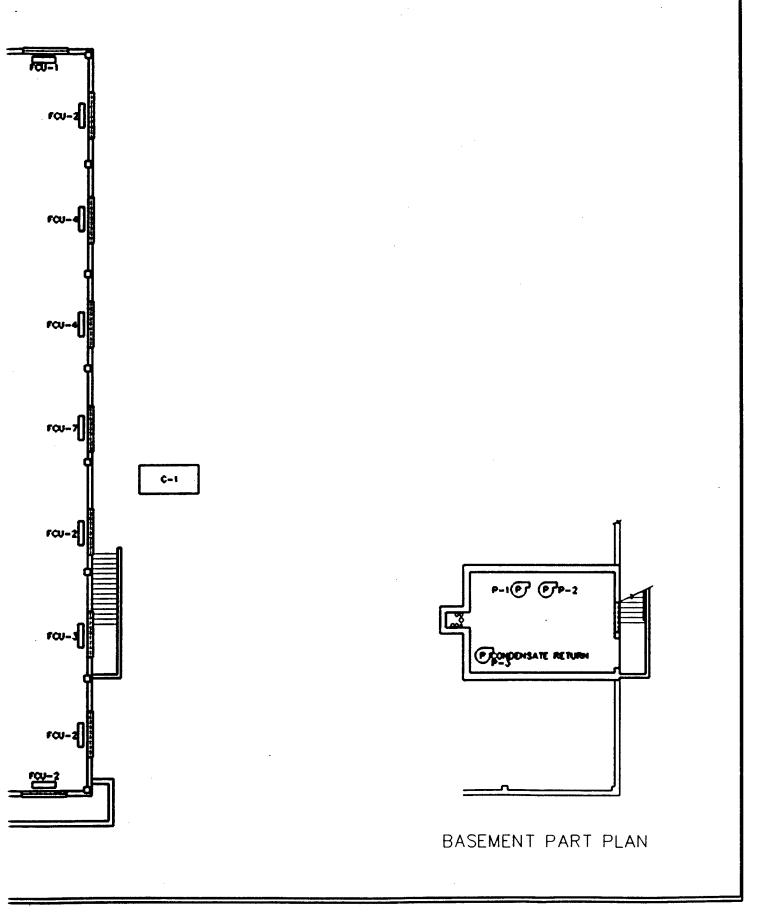
ARCHITECTURE & ENGINEERING, P.C.

BHE ARGUS BUILDING BROADWAY AT BEAVER POST OFFICE BOX 617 ALBANY, NY 12201-0517 EL (518) 463-2141

THE FLOUR MILL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 TEL. (202) 471-5000





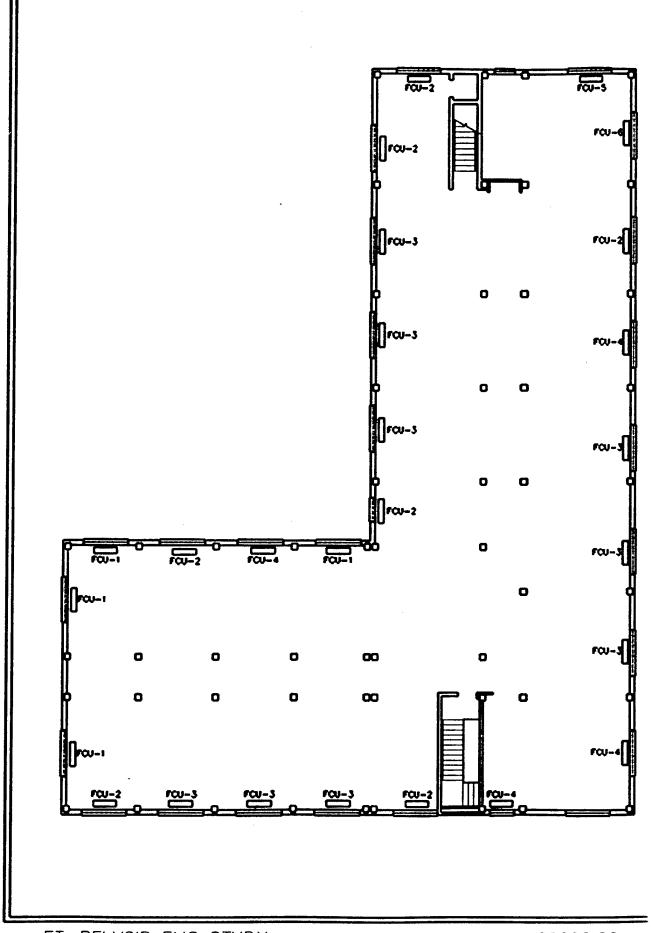




ARCHITECTURE & ENGINEERING, P.C.

THE AROUS BUILDING BROADWAY AT BEAVER POST OFFICE BOX 617 ALBANY, NY 12201-0617 TEL. (518) 463-2141

BNE FLOUR MILL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 WL. (202) 471-5000



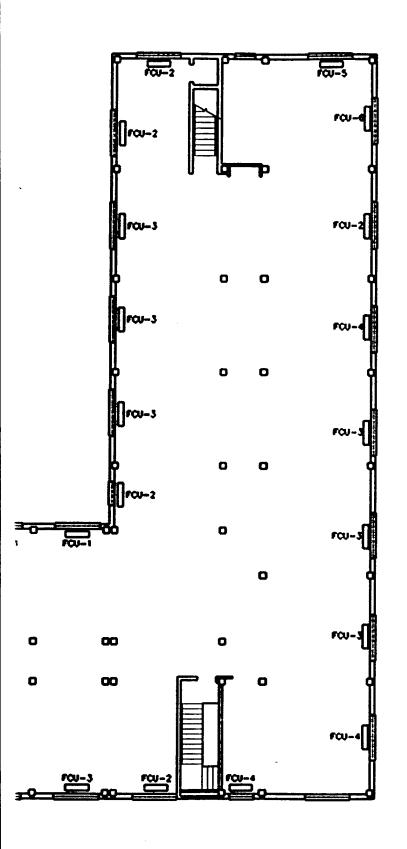
Project: FT. BELVOIR EMS STUDY

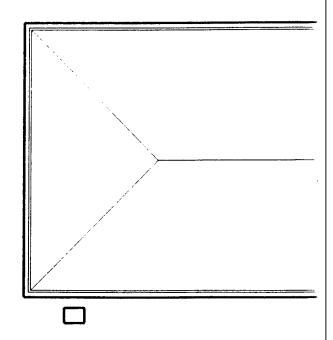
Project No : 60692.00

Designed by:

Drown by: FE/DLS

0 B-16





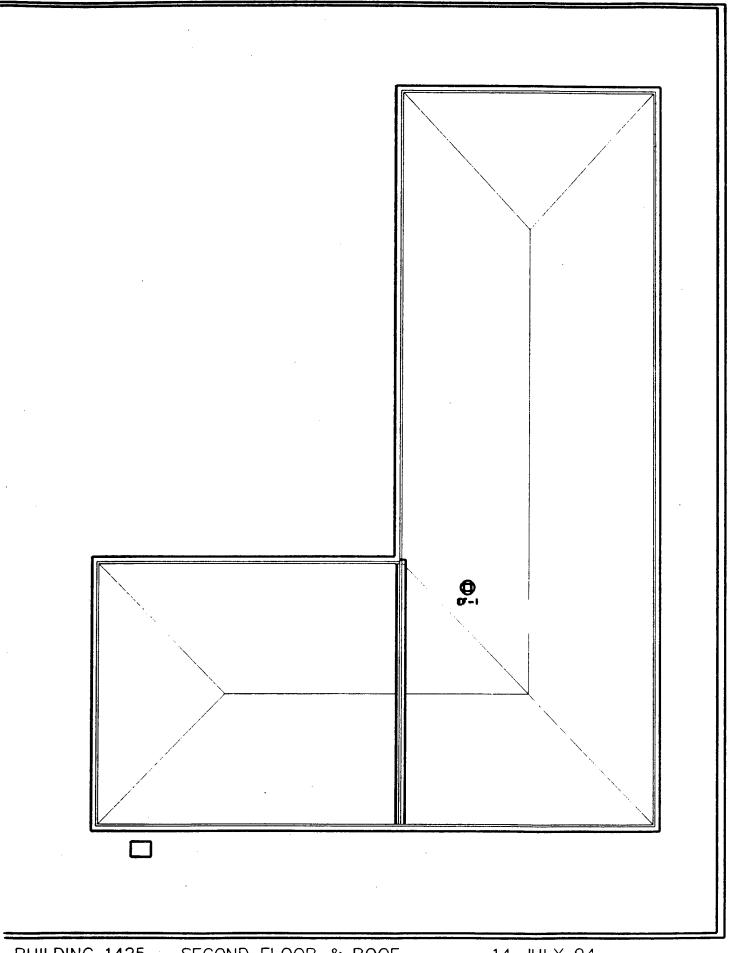
Project No.: 60692.00

Designed by: FE/DLS

B-16

BUILDING 1425 - SECOND FLOOR & ROC MECHANICAL EQUIPMENT LOCATION PLAN

Modifies Drawing No.: Scale: 1/16" = 1'



BUILDING 1425 - SECOND FLOOR & ROOF

MECHANICAL EQUIPMENT LOCATION PLAN

Sheet 16.: 2 of: 2

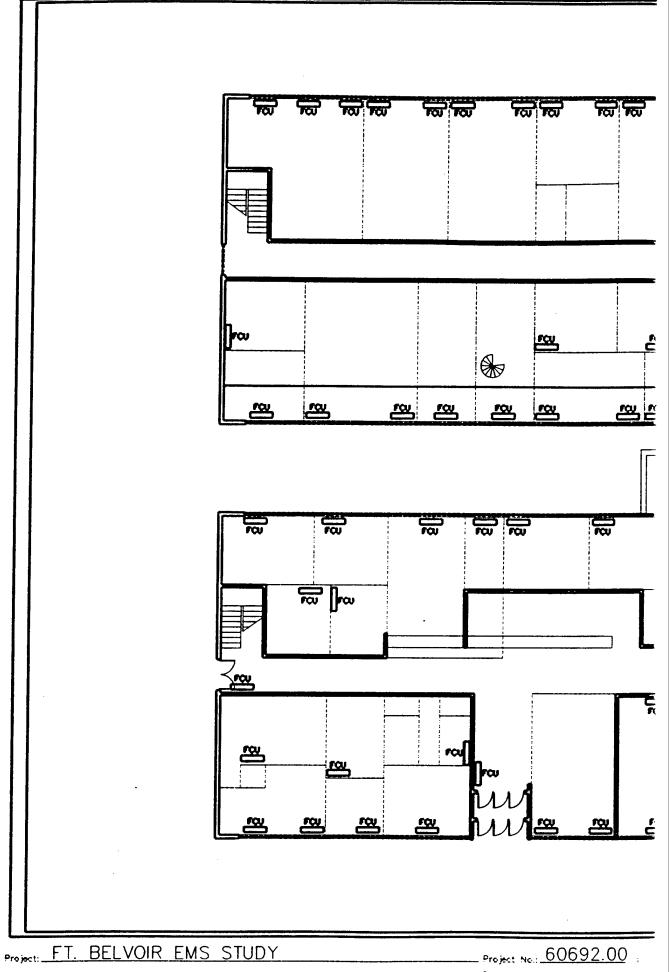
les Drowing 190.: Scoie: 1/16" = 1'-0" Drowing 190.:

**BUILDING 3136** 



ARCHITECTURE & ENGINEERING, P.C.
THE ARGUS BUILDING BROADWAY AT BEAVER POST OFFICE BOX 617
ALBANY, NY 12201-0617
TEL (518) 463-2141

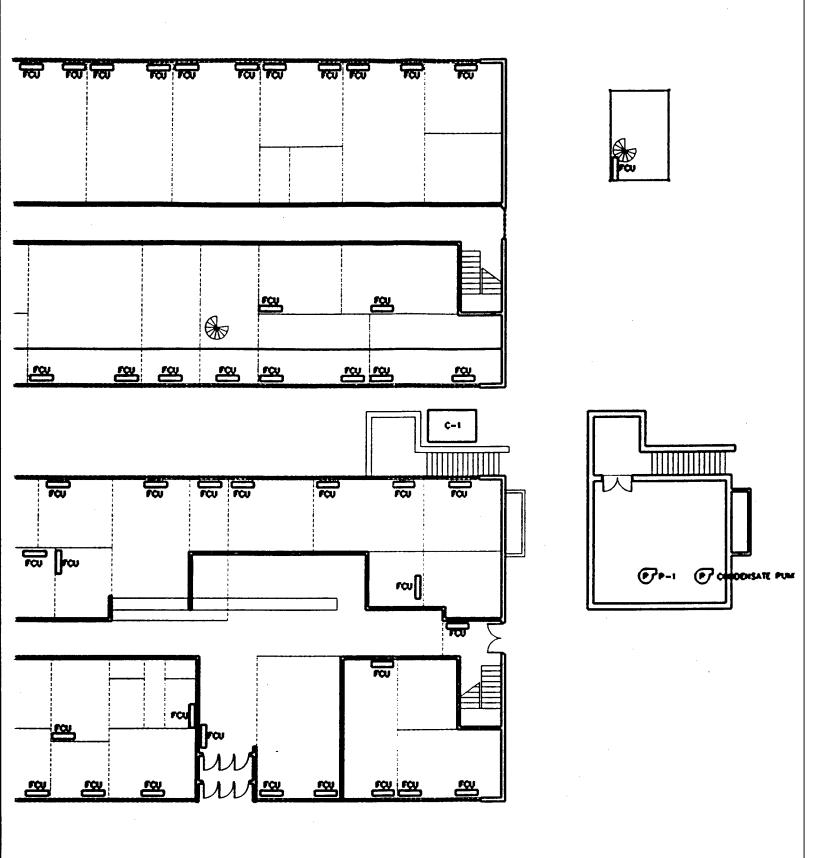
RE FLOUR MILL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 EL. (202) 471-5000



Designed by:

Drown by FE/DLS

(1) B-18



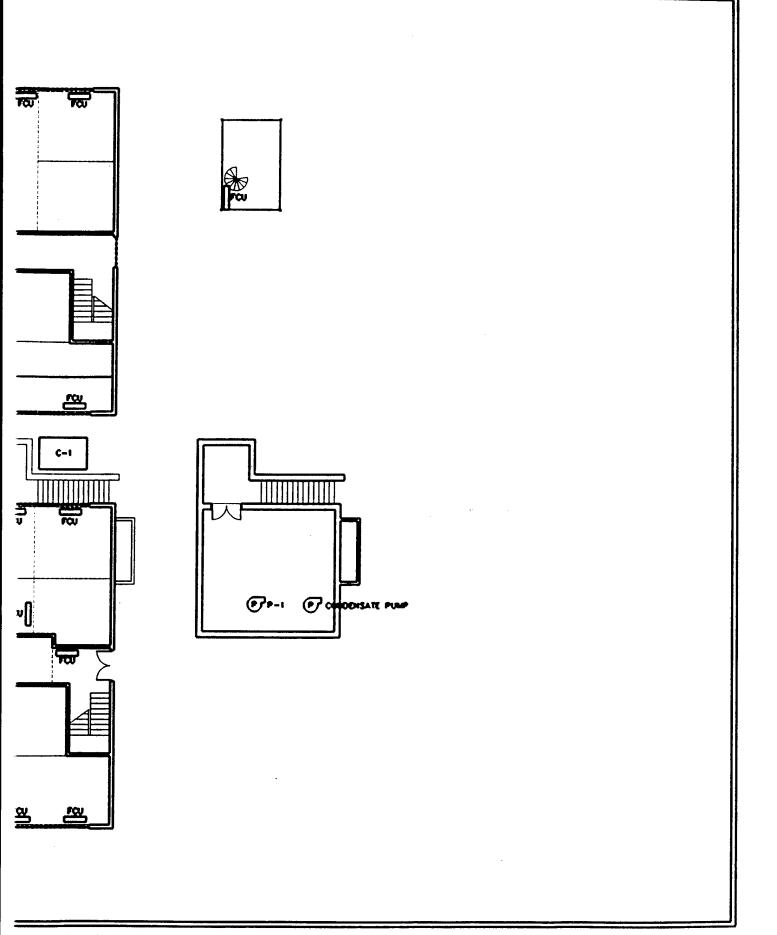
Project No.: 60692.00 Fitle: BI

Designed Sy: FE/DLS hodifies D

FLOOR EQUIPMENT LOCATION PLANS

| Scoie: 1/16" = 1'0

7-18



: BUILDING 3136 — FIRST AND SECON
FLOOR EQUIPMENT LOCATION PLANS

Sheet No.: 1 of 1

ifies Drawing No. Scoie: 1/16" = 1'0" Drawing No.:

(3)

# APPENDIX C CARRIER E20-II BUILDING SIMULATION INPUT DATA

**BUILDING 200** 

Page 1 of 1

HAP v3.04 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

## TABLE 1. SIMULATION WEATHER DATA DESIGN PARAMETERS

City....: Washington

Location..... Dist. of Columbia

Type of Data..... Typical Meteorological Year

Latitude....: 38.9 deg Longitude...: 77.0 deg

Elevation....: 14.0 ft

\* Average Ground Reflectivity..... 0.20

Local Time Zone (GMT +/- N hours)..... 5.0 hours

\* Daylight Savings Time Considered.....? N

\_\_\_\_\_ \* = User-defined design parameters. All other values are fixed.

TABLE 2. DRY-BULB TEMPERATURE STATISTICS (F) \_\_\_\_\_\_

Absolute Average Average Absolute Maximum Maximum Average Minimum Minimum \_\_\_\_\_\_ January 60.4 39.3 30.7 21.0 February 62.1 42.8 33.1 22.9 March 75.5 53.9 43.3 32.4 April 85.5 65.7 55.0 44.3 May 91.9 73.3 63.5 53.8 June 93.5 80.8 70.0 58.8 July 91.0 84.9 75.9 66.5 August 96.8 85.1 74.3 64.5 September 91.6 79.3 69.3 60.0 October 84.7 67.5 56.8 46.7 7.5 17.1 31.2 40.5 48.8 17.1 55.8 49.6 46.5 23.4 75.7 56.4 46.6 35.7 59.0 42.7 36.9 30.9 17.3 November 20.5 December \_\_\_\_\_

TABLE 3. DAILY TOTAL SOLAR RADIATION STATISTICS

Daily Matal Color | | Daily Clearness Number

	[ Dail	ly Total So	olar]	[ Daily	Clearness N	Number]
		(BTU/sqft)		(Di	mensionless	5)
Month	Maximum	Average	Minimum	Maximum	Average	Minimum
				0.640	0.430	0.107
January	1043.4	609.1	137.7	0.648	0.430	0.107
February	1448.6	815.5	79.9	0.685	0.433	0.048
March	1861.2	1183.4	211.6	0.680	0.473	0.094
April	2371.0	1484.8	247.6	0.717	0.479	0.079
May	2579.4	1712.0	355.4	0.711	0.487	0.104
June	2551.8	1890.8	515.8	0.697	0.514	0.140
July	2398.3	1714.6	629.5	0.657	0.478	0.171
August	2378.9	1696.2	708.2	0.694	0.522	0.227
September	1943.6	1307.6	258.0	0.674	0.482	0.094
October	1546.1	977.2	92.6	0.656	0.469	0.045
November	1143.4	672.4	129.4	0.647	0.437	0.094
December	803.2	488.0	73.1	0.618	0.382	0.057

Notes: \* All solar data is daily total flux on a horizontal surface.

<sup>\*</sup> Clearness number is (Daily Total Solar)/(Extraterrestrial Solar) Values between 0.70 and 0.80 represent clear conditions.

## CALENDAR DATA

Calendar Name: Sample Calendar	Day Type Assignments  Monday = Weekday
January first is on: Friday	Tuesday = Weekday
	Wednesday = Weekday
Day Type Names	Thursday = Weekday
Day Type 1 = Weekday	Friday = Weekday
Day Type 2 = Saturday	Saturday = Saturday
Day Type $3 = Sunday$	Sunday = Sunday
	Holiday = Sunday

## SCHEDULE DATA

Prepared By: 1 HAP v3.04 ***********						****	****	****	****	Page ****	12-3 1 o ****	f 1
Schedule Name: Assembly Spaces Hourly Percentages												
Hour>	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY Weekday	0   0	0	0	0	0   0	0   0	0   0	10   10	25   25	50   25	75	100
Saturday	0	0	0	0	0	0	0	0	0	0	10	25
Sunday	0 	0	0		0	0	0 <del>-</del>	0	0	0	10	25
Hour>	12	13	14	15	16	17	18	19	20	21	22	23
DESIGN DAY	100	100	100	100	100	100	100	100	100	100	75	100
Weekday Saturday	40	40	40	30   30	25   25	25	25	25	25   25	25	20	10
Sunday	25	40	40	30	25	25	25	10	0	0	0	0
	**************************************								****			
Hour>	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY	0	0	0	0	0	0	O	10	25	50	   75	100
Weekday	0	0	0	0	0	0	0	10	25	50	75	100
Saturday Sunday	0   0	0   0	0	0	0   0	0	0   0	0   0	0	0	10	25
Hour>	12	13	14 	15	16	17	18 	19 	20	21 	22	23
DESIGN DAY	100	100	100	100	100	100	100	100	100	100	75	10
Weekday Saturday	100	100	100   50	100   75	100  100	100  100	100	100	100	100	75 100	10
Sunday	50	75	100	100	100	100	100	100	0	0	0	0
*****			****	****	****	****					****	****
Schedule Name	: Lig. 	hts 					Hou 	rly P	ercen 	tages		
Hour>	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY	25	25	25	25	25	25	1	100	!	100	100	100
Weekday Saturday	25	25	25	25 25	25	25	25	100	100	100	100	100
Sunday	25 25	25 25	25	25	25	25	25	25	25 25	25	25 100	25 100
Hour>	12	   13	   14	   15	   16	   17	   18	19	20	21	22	23
DESIGN DAY	100	100	100	100	100	100	  100	100	100	100	100	100
Weekday	100	100	100	100	100	100	100	100	100	100	100	100
Saturday	100	100	100	100	100	100	100	100	100	100	100	100
Sunday *********	100 ****	100 ****	100 ****	100 ****	100 ****	100 ****	100 ****	100 ****	25 ****	25 ****	25 ****	25 ****

## WALL CONSTRUCTION TYPES

MATTE	COMBINGCITON	111110			
Prepared by: EINHORN YAFFEE F HAP v3.04	RESCOTT				2-30-94 Page :
*******	*****	****	*****		<b>-</b>
WALL TYPE 1: (CUSTOM WALL)					
Description Brick	:/Block				
Absorptivity 0.900					
Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
			<b></b>		
Inside surface resistance	-	-	-	0.69	-
6in LW concrete block	6.00	19.0	0.21	1.65	9.5
Vermiculite Insulation	3.00	6.0	0.32	6.45	1.5
Airspace	1.00	0.0	0.00	0.91	0.0
4-in (102 mm) face brick	4.00	125.0	0.22	0.43	41.7
Outside surface resistance		_	_	0.33	_
Totals	14.00			10.46	52.7
Thickness: in	Density: lb/cu	 f <del>†</del>	Weiah	nt: lb/:	- <b></b>
R-value : (hr-sqft-F)/BTU	<u>-</u>		_	/	-4-0
it varace . (iii bare r//bro	opecatio meac.		•		

# ROOF CONSTRUCTION TYPES

Prepared by: EIN	NHORN YAFFEE PRESCOTT	12-30-94
HAP v3.04		Page 1
******	*************	******
	PRE-DEFINED ROOF)	
	BUILT-UP ROOF ON STEEL OR WOOD	
Туре:	Built-up roof + R-7 board + steel deck	
Description:	Pre-Defined Roof	
U-value:	0.121 BTU/hr/sqft/F	
Color:	Dark	
Roof Construction	on (Inside to Outside):	
	22 gage steel deck	
	R-7 (RSI-1.2) board insulation	
	Built-up roofing	

# WINDOW TYPE CONSTRUCTIONS

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94 HAP v3.04 Page 1 ************************************						
WINDOW TYPE 1: (PR						
Glass Group Glass Type Window Description. Height Width Frame Type Interior Shade Type Overall U-value Overall Shade Coeff	: SINGLE I: 1/4" cl: Pre-Defi: 1.00: Aluminum: No Shade: 1.077	PANE, CLEAR Lear ined Window ft ft ft n with thermal br es Used BTU/hr/sqft/F				
	Predefi	ined Glass Data				
Glass Transmissivity R 0.792	Glass eflectivity 0.079	Glass Absorptivity 0.129	1.090	Shade Coefficient 0.960		
WINDOW TYPE 2: (PR						
Glass Group :: SINGLE PANE, CLEAR  Glass Type :: 1/8" clear  Window Description :: Pre-Defined Window  Height :: 1.00 ft  Width :: 1.00 ft  Frame Type :: Aluminum with thermal breaks  Interior Shade Type :: No Shades Used  Overall U-value :: 1.094 BTU/hr/sqft/F  Overall Shade Coeff :: 0.903						
	Predefi	ined Glass Data				
Glass Transmissivity R 0.841	Glass eflectivity 0.078	Glass Absorptivity 0.081	Glass U-Value 1.110	Shade Coefficient 1.000		

#### ELECTRIC RATE DATA

Prepared by: EI	NHORN YAFFEE PRESCOTT	12-30-94
HAP v3.04		Page 1
*****	***************	******
BASIC ELECTRIC	RATE INFORMATION	
ELECTRIC RATE INFORMATION:	Rate schedule name: Ft. Belvoir Equivalent Currency symbol	\$ \$/kWh
	Flat rate 0.01968	\$/kWh

# FUEL RATE DATA

HAP v3.04	NHORN YAFFEE PRESCOTT	12-30-94 Page 1 ********
BASIC FUEL RATE	INFORMATION	
FUEL RATE INFORMATION:	Rate schedule name : Ft. Currency symbol : Units of measurement : Fuel conversion factor : Type of rate schedule : Flat rate :	\$ 1000 lb 1000.00000 kBTU/1000 lb Simple

# FUEL RATE DATA

Prepared by: EI	NHORN YAFFEE PRESCOTT	12-30-94
HAP v3.04		Page 1
*****	************	******
BASIC FUEL RATE	INFORMATION	
FUEL RATE	Rate schedule name: Washington Gas Ra	te Schedule 2
INFORMATION:	Currency symbol \$	·
	Units of measurement Therm	
	Fuel conversion factor: 100.00000 k	BTU/Therm
	Type of rate schedule Simple	
	Flat rate 0.60790 \$	5/Therm

Prepared by: EINHO	RN YAFFEE	PRESCOTT				12-30-94
HAP v3.04						Page 1
******	*****	*****	*****	******	*****	*****
GENERAL			SCHEDULE			
Name: AHU-1	Assembly	/ Trave				
Floor Area:	1728.0	sqft	Task Lig	ghts.: Light	s	
Building Weight.:	70.0	lb/sqft	People.	: Assem	nbly Spac	ces
Windows Shaded?	N		Equipmen	nt: Peopl	.e	
Partitions Used.?	Y			ens: Peopl		
LIGHTING				atent: Peopl		
Overhead Fixture:	Recessed		INFILTRA'	-		
Lamp Wattage:	3.00	W/sqft	Cooling	:	0.00 CF	M/saft
Ballast Mult:		,	Heating			
Task Lighting:		W/sqft	Typical		0.00 CFI	M/aaft
PEOPLE		=	When Fai		N N	n/ sqrc
Occupancy:		caft/no			1//	
Activity Level:	Office Wo	sdrc/be	Time	:Slab C	n Canada	
				:Slab C		100 0 ft
Sensible:				oor Area		100.0 ft
Latent:	205.0	BTU/hr				80.0 sqft
OTHER LOADS	0.00	T.T / E +-		-Value		2.40
Equipment:	0.00	W/sqit	Insulati	ion R-value.	:	0.00
Misc. Sensible:	0.0	BTU/hr BTU/hr				
Misc. Latent:						
						f
WALL Gross Area		WIN		WINDOW	-	Any
Exp (sqft)			ty Snade	Type Qty	Snade	Doors?
N 384.0			0 -	1 0	-	N
E 783.0	i	1 2	40 -	1 0	_	N
:	1				.======	
ROOF Slope Gro	ss Area	ROOF	SKYLIGHT			
Exp (deq)	(sqft)	Type T	ype Qty			
	<del>-</del>					
HOR -	1728.0	1	1 0	ĺ		
			========			
PARTITION LOADS	T	ype 1		Type 2	2	
				Ceiling	· <b></b>	
Area				0.0	) aaft	
U-value		200.0 SY	II/b~/a~f+/:	F 0.500	Sqrt	/a~f+ /E
			O/HE/SQLC/.			/sqrc/r
Maximum Space Temp		95.0 F		75.0		
Outside Air Temp @		95.0 F		55.0		
Minimum Space Temp		0.0 F		75.0		
Outside Air Temp @				54.0	, r	

C-II Village 18th 1 - 1 A-2.

Prepared by: EINHORN YAFFEE	PRESCOTT		12-30-94
HAP v3.04			Page 1
********	*****	*****	*****
GENERAL	SCHEDULES	3	
Name: AHU 2-1 Multi-P	urpose Lightino	g: Lights	
Floor Area: 2376.0		hts.: Lights	
Building Weight.: 70.0		: Assembly Space	ces
Windows Shaded? N	Equipmer	nt: People	
Partitions Used.? N	Misc. Se	ens: People	
LIGHTING	Misc. La	tent: People	
Overhead Fixture: Recessed	INFILTRAT	TION	
Lamp Wattage: 3.60	W/sqft Cooling.	: 0.00 CFN	M/sqft
Ballast Mult: 1.00	Heating.	: 0.00 CFN	M/sqft
Task Lighting: 0.00	W/sqft Typical.	: 0.00 CFN	M/sqft
PEOPLE	When Far	on.? N	
Occupancy: 40.0			
Activity Level: Sedentary		:Slab On Grade	
	•	er:	130.0 ft
Latent 270.0		oor Area:	
OTHER LOADS		-Value:	2.40
Equipment: 0.00		lon R-value:	0.00
Misc. Sensible: 0.0	•		
	BTU/hr		
			========
WALL Gross Area   WALL	•	WINDOW	Any
Exp (sqft) Type	Type Qty Shade	Type Qty Shade	Doors?
W 440.0   1	1 75 -	1 0 -	N
		=======================================	========
ROOF Slope Gross Area	,		
Exp (deg) (sqft)	Type Type Qty		
HOR - 2376.0	1   1 0		
No partition data for this s			========
<del>-</del>	=		

Prepared by: EINHOR	RN YAFFEE	PRESCO	TT					12-30-94
HAP v3.04								Page 1
******	******	*****	****	****	*****	****	*****	*****
GENERAL			S	CHEDULE	S			
Name: AHU 2-	-2 Stage			Lighting	g:	Light	3	
Floor Area:	1620.0	sqft		Task Lig	ghts.:	Light	3	
Building Weight.:	70.0	lb/sq	[ft	People.	:	Asseml	oly Spa	ces
Windows Shaded?	N			Equipmen	nt:	People	9	
Partitions Used.?	N			Misc. Se	ens:	People	e	
LIGHTING				Misc. La	atent:	People	e	
Overhead Fixture:	Recessed		I	NFILTRA	TION			
Lamp Wattage:	5.00	W/sqf	t	Cooling	:		0.00 CF	
Ballast Mult:	1.00			Heating	:	(	0.00 CF	M/sqft
Task Lighting:	0.00	W/sqf	t	Typical	:	(	0.00 CF	M/sqft
PEOPLE				When Far	n On.?		N	
Occupancy:			_					
Activity Level:				Туре				
Sensible:		BTU/h		Perimet				130.0 ft
Latent:	455.0	BTU/h		Slab Flo				1620.0 sqft
OTHER LOADS				Floor R				2.40
Equipment:		_		Insulat	ion R-v	alue.	:	0.00
Misc. Sensible:		BTU/h						
Misc. Latent:	0.0	BTU/h	ır					
=======================================		=====	=====	======		=====	======	========
WALL Gross Area	WALL		INDOW		!	INDOW		Any
Exp (sqft)	Туре	Туре	Qty	Shade	Type	Qty	Shade	Doors?
350.0								
W 360.0	1	1 1	0	_	1	0	-	N
N 864.0	1	1	0	-	1	0	-	N
DOOF Clara Cros	========	ROOF		LIGHT	====== 	=====:		=======
-			!		] 			
Exp (deg)	(sqft)	Туре	l i Abe	Qty	 			
HOR -	1620.0	1	1	0	! 			
108	· ·		-		 <b>====</b> ===			<b></b>
No partition data f								
Parararar adda		L 220.						

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				RIPIION				
Prepared by: EINHORN	YAFFEE 1	PRESCO'	$\operatorname{TT}$					12-30-94
HAP v3.04								Page 1
******	*****	****				****	*****	*****
GENERAL				CHEDULES	_			
Name: AHU 2-3	Multi-Pu	urpose		Lighting	J:	Lights	5	
Floor Area:	2135.0			Task Lig				
Building Weight.:	70.0	lb/sq	ft :	People	:	Asseml	oly Spac	ces
Windows Shaded?	N			Equipmer	nt:	People	e	
Partitions Used.?	N		1	Misc. Se	ens:	People	=	
LIGHTING			1	Misc. La	atent:	People	<b>e</b>	
Overhead Fixture: Re	cessed		I.	NFILTRAT	rion			
Lamp Wattage:	3.60	W/sqf	t ·	Cooling.	:	(	0.00 CFN	1/sqft
Ballast Mult:	1.00			Heating.			0.00 CFN	· · · · · · · · · · · · · · · · · · ·
Task Lighting:	0.00	W/sqf	t '	Typical.	:	(	0.00 CFN	1/sqft
PEOPLE				When Far	n On.?		N	
Occupancy:	40.0	sqft/	per F	LOOR				
Activity Level: Se				Type	:S	lab O	n Grade	
Sensible:	280.0	BTU/h	r	Perimete	er		:	140.0 ft
Latent:	270.0	BTU/h	r	Slab Flo	oor Are	a	:	2135.0 sqft
OTHER LOADS				Floor R-	-Value.		:	2.40
Equipment:	0.00	W/sqf	t	Insulat	ion R-v	alue.	:	0.00
Misc. Sensible:	0.0	BTU/h	r					
Misc. Latent:	0.0	BTU/h	r					
=======================================	======	=====	====	======		=====		
WALL Gross Area	WALL		INDOW			INDOW		Any
Exp (sqft)	Type	Type	Qty	Shade	Туре	Qty	Shade	Doors?
		<b>-</b>					<b>-</b>	
E 480.0	1	1	20		1	0	-	N
S 286.0	1		96	-	! -	0	-	N
SE 420.0	1	1	0	-	1	0	-	N
						=====	======	========
ROOF Slope Gross		ROOF	1 '	LIGHT				
	sqft)	Туре	Type	Qty				
HOR - 21	.35.0 l	1	1 1		1			
HOR - 21		_	_	_	 			
No partition data for								
No partition data for this space.								

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Prepared by: EINHOR HAP v3.04	RN YAFFEE	PRESCO	TT					12-30-94
*******	******	*****	****	*****	*****	****	*****	Page 1
GENERAL				CHEDULE				
Name: AHU 3	Concours	е		Lighting	9:	Lights	3	
Floor Area:	4500.0	sqft		Task Lig				
Building Weight.:		lb/sq		People.	_	-		
Windows Shaded?	N	_		Equipmen				
Partitions Used.?	N			Misc. Se				
LIGHTING				Misc. La				
Overhead Fixture:	Recessed		I	NFILTRA'	TION	-		
Lamp Wattage:	2.00	W/sqf	t	Cooling	:	(	0.00 CF	M/sqft
Ballast Mult:	1.00			Heating	:		0.00 CF	-
Task Lighting:	0.00	W/sqf	t	Typical	:		0.00 CF	· •
PEOPLE		_		When Far	n On.?		N	. 4
Occupancy:	225.0	sqft/	per F	LOOR				
Activity Level:				Туре	: 5	lab Or	n Grade	
Sensible:	245.0	BTU/h		Perimete				80.0 ft
Latent:	205.0	BTU/h	r.	Slab Flo	oor Are	a	:	4500.0 sqft
OTHER LOADS				Floor R	-Value.		:	2.40
Equipment:	0.00	W/sqf	t	Insulat:	ion R-v	alue.	:	0.00
Misc. Sensible:	0.0	BTU/h	r					
Misc. Latent:	0.0	BTU/h	r					
		=====	=====	======	======	=====	======	========
WALL Gross Area	WALL	W	INDOW		N W	NDOW		Any
Exp (sqft)	Type	Туре	Qty	Shade	Type	Qty	Shade	Doors?
s 960.0	1 1	1	765		<u>-</u>	0	<b></b>	N
N 620.0	1 1	1	510	_	1	0	-	N
' 		=====			======	=====	======	
ROOF Slope Gros	ss Area	ROOF	SKY	LIGHT				
Exp (deg)	(sqft)	Туре						
HOR -	2313.0	1	2	540	1			
============				======	======	=====	=====	========
No partition data f	for this s	pace.						
		=====	=====	======		=====		========

Prepared by: EINHORN YAFFEE PRESCOTT HAP v3.04	12-30-94 Page 1					
	rage 1					
GENERAL	SCHEDULES					
Name: AHU 4-1 Music Room	Lighting: Lights					
Floor Area: 340.0 sqft	Task Lights.: Lights					
Building Weight.: 70.0 lb/sqft	People: People					
Windows Shaded? N	Equipment: People					
Partitions Used.? N	Misc. Sens: People					
LIGHTING	Misc. Latent: People					
Overhead Fixture: Recessed	INFILTRATION					
Lamp Wattage: 3.00 W/sqft	Cooling: 0.00 CFM/sqft					
Ballast Mult: 1.00	Heating: 0.00 CFM/sqft					
Task Lighting: 0.00 W/sqft	Typical: 0.00 CFM/sqft					
PEOPLE	When Fan On.? N					
Occupancy: 170.0 sqft/per	FLOOR					
Activity Level: Office Work	Type:Slab On Grade					
Sensible: 245.0 BTU/hr	Perimeter 0.0 ft					
Latent 205.0 BTU/hr	Slab Floor Area: 340.0 sqft					
OTHER LOADS	Floor R-Value 2.40					
Equipment: 0.00 W/sqft	Insulation R-value: 0.00					
Misc. Sensible: 0.0 BTU/hr						
Misc. Latent: 0.0 BTU/hr						
	=======================================					
No external wall or window data for this space.						
	KYLIGHT					
Exp (deg) (sqft) Type Ty	pe Qty					
HOR - 340.0   1	2 0					
=======================================	=======================================					
No partition data for this space.						

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Prepared by: EINHORN YAFFEE PRESCOTT HAP v3.04	12-30-94 Page 1					
*********	**********					
GENERAL	SCHEDULES					
Name: AHU 4-2 TV Room	Lighting: Lights					
Floor Area: 578.0 sqft						
Building Weight.: 70.0 lb/sqft						
Windows Shaded? N	Equipment: People					
Partitions Used.? N	Misc. Sens: People					
LIGHTING	Misc. Latent: People					
Overhead Fixture: Recessed	INFILTRATION					
Lamp Wattage: 2.10 W/sqft	Cooling: 0.00 CFM/sqft					
Ballast Mult: 1.00	Heating: 0.00 CFM/sqft					
Task Lighting: 0.00 W/sqft	Typical: 0.00 CFM/sqft					
PEOPLE	When Fan On.?					
Occupancy: 144.0 sqft/per	FLOOR					
Activity Level: Seated at Rest	Type:Slab On Grade					
Sensible: 230.0 BTU/hr	Perimeter 0.0 ft					
Latent: 120.0 BTU/hr	Slab Floor Area: 578.0 sqft					
OTHER LOADS	Floor R-Value 2.40					
Equipment: 0.00 W/sqft	Insulation R-value: 0.00					
Misc. Sensible: 0.0 BTU/hr						
Misc. Latent: 0.0 BTU/hr						
No external wall or window data for this space.						
	YLIGHT					
Exp (deg) (sqft) Type Typ						
HOR - 578.0   1	2 0					
=======================================						
No partition data for this space.						
=======================================						

Prepared by: EINHORN YAFFEE PRESCOTT	12-30-94		
HAP v3.04	Page 1		
**********	***********		
GENERAL	SCHEDULES		
Name: AHU 4-3 Mini Auditorium	Lighting: Lights		
Floor Area: 250.0 sqft	Task Lights.: Lights		
Building Weight.: 70.0 lb/sqft	People: Assembly Spaces		
Windows Shaded? N	Equipment: People		
Partitions Used.? N	Misc. Sens: People		
LIGHTING	Misc. Latent: People		
Overhead Fixture: Recessed	INFILTRATION		
Lamp Wattage: 4.20 W/sqft	Cooling: 0.00 CFM/sqft		
Ballast Mult: 1.00	Heating: 0.00 CFM/sqft		
Task Lighting: 0.00 W/sqft	Typical: 0.00 CFM/sqft		
PEOPLE	When Fan On.?		
Occupancy: 50.0 sqft/per	FLOOR		
Activity Level: Seated at Rest	Type:Slab On Grade		
Sensible: 230.0 BTU/hr			
Latent 120.0 BTU/hr	Slab Floor Area: 250.0 sqft		
OTHER LOADS	Floor R-Value 2.40		
Equipment: 0.00 W/sqft	Insulation R-value: 0.00		
Misc. Sensible: 0.0 BTU/hr			
Misc. Latent: 0.0 BTU/hr			
	=======================================		
No external wall or window data for this space.			
ROOF Slope Gross Area   ROOF   S	KYI.TGHT		
Exp (deg) (sqft)   Type   Ty			
HOR - 250.0   1	2 0		
	=======================================		
No partition data for this space.			

Prepared by: EINHORN YAFFEE PRES	SCOTT 12-30-94
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********	*************
GENERAL	SCHEDULES
Name: AHU 4-4 Crafts Room	m Lighting: Lights
Floor Area: 480.0 sqi	
Building Weight.: 70.0 lb/	y/sqft People: People
Windows Shaded? N	Equipment: People
Partitions Used.? N	Misc. Sens: People
LIGHTING	Misc. Latent: People
Overhead Fixture: Recessed	INFILTRATION
Lamp Wattage: 3.00 W/s	sqft Cooling: 0.00 CFM/sqft
Ballast Mult: 1.00	Heating: 0.00 CFM/sqft
Task Lighting: 0.00 W/s	sqft Typical: 0.00 CFM/sqft
PEOPLE	When Fan On.?
Occupancy: 50.0 sqi	
Activity Level: Seated at Res	
Sensible: 230.0 BTU	,
Latent 120.0 BTG	
OTHER LOADS	Floor R-Value: 2.40
Equipment: 0.00 W/s	
Misc. Sensible: 0.0 BTU	
Misc. Latent: 0.0 BT	·
WALL Gross Area   WALL	12
Exp (sqit)   Type   Typ	pe Qty Shade   Type Qty Shade   Doors?
1	1 0 -   1 0 -   N
ROOF Slope Gross Area   ROO	
Exp (deg) (sqft) Tyr	
HOR - 480.0	1   2 0
No partition data for this space	

Prepared by: EINHORN YAFFEE	PRESCOTT	12-30-94
HAP v3.04		Page 1
*******	*****	********
GENERAL	SCHEDULES	5
Name: AHU 4-5 Reading	Room Lighting	g: Lights
Floor Area: 504.0	sqft Task Lig	ghts.: Lights
Building Weight.: 70.0		: People
Windows Shaded? N	T Equipmen	nt: People
Partitions Used.? N	Misc. Se	ens: People
LIGHTING	Misc. La	atent: People
Overhead Fixture: Recessed	INFILTRAT	TION
Lamp Wattage: 2.40	W/sqft Cooling.	: 0.00 CFM/sqft
Ballast Mult: 1.00	Heating	: 0.00 CFM/sqft
Task Lighting: 0.00	W/sqft Typical.	: 0.00 CFM/sqft
PEOPLE	When Far	n On.? N
Occupancy: 100.0	sqft/per FLOOR	
Activity Level: Seated at	Rest Type	:Slab On Grade
	BTU/hr Perimete	er 0.0 ft
Latent 120.0	•	oor Area: 504.0 sqft
OTHER LOADS		-Value 2.40
Equipment: 0.00		ion R-value: 0.00
Misc. Sensible: 0.0		
Misc. Latent: 0.0	•	
WALL Gross Area WALL		WINDOW   Any
Exp (sqft)   Type	Type Qty Shade	Type Qty Shade   Doors?
		· · · · · · · · · · · · · · · · · · ·
S 288.0   1	1 144 -	1 0 - N
DOOR Glass Grass Area		=======================================
ROOF Slope Gross Area		
Exp (deg) (sqft)	Type   Type Qty	
HOR - 504.0	1 2 0	<u> </u> 
	- 1	 ====================================
No partition data for this s		
	<u>-</u>	

Prepared by: EINHORN YAFFEE PRESCO	OTT 12-30-94
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********	************
GENERAL	SCHEDULES
Name: AHU 4-6 Office	Lighting: Lights
Floor Area: 588.0 sqft	Task Lights.: Lights
Building Weight.: 70.0 lb/sq	qft People: People
Windows Shaded? N	Equipment: People
Partitions Used.? N	Misc. Sens: People
LIGHTING	Misc. Latent: People
Overhead Fixture: Recessed	INFILTRATION
Lamp Wattage: 2.00 W/sqf	ft Cooling: 0.00 CFM/sqft
Ballast Mult: 1.00	Heating: 0.00 CFM/sqft
Task Lighting: 0.00 W/sqf	ft Typical: 0.00 CFM/sqft
PEOPLE	When Fan On.?
Occupancy: 294.0 sqft/	/per FLOOR
Activity Level: Office Work	Type:Slab On Grade
Sensible: 245.0 BTU/h	hr Perimeter 28.0 ft
Latent 205.0 BTU/h	hr Slab Floor Area: 588.0 sqft
OTHER LOADS	Floor R-Value 2.40
Equipment: 0.00 W/sqf	ft Insulation R-value: 0.00
Misc. Sensible: 1500.0 BTU/h	hr
Misc. Latent: 0.0 BTU/h	hr
=======================================	=======================================
WALL Gross Area   WALL   W	1
Exp (sqft)   Type   Type	Qty Shade   Type Qty Shade   Doors?
S 336.0   1   1	24 -   1 0 -   N
ROOF Slope Gross Area ROOF	SKYLIGHT
_	Type Qty
HOR - 588.0   1	2 0
	1 - 1
No partition data for this space.	
The second secon	

Prepared by: EINHORN YAFFEE PRESCOTT	12-30-94
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**********	***********
GENERAL	SCHEDULES
Name: AHU 4-7 Offices	Lighting: Lights
Floor Area: 710.0 sqft	Task Lights.: Lights
Building Weight.: 70.0 lb/sqft	People: People
Windows Shaded? N	Equipment: People
Partitions Used.? N	Misc. Sens: People
LIGHTING	Misc. Latent: People
Overhead Fixture: Recessed	INFILTRATION
Lamp Wattage: 2.50 W/sqft	Cooling: 0.00 CFM/sqft
Ballast Mult: 1.00	Heating: 0.00 CFM/sqft
Task Lighting: 0.00 W/sqft	Typical: 0.00 CFM/sqft
PEOPLE	When Fan On.?
Occupancy: 236.0 sqft/per	FLOOR
Activity Level: Office Work	Type:Slab On Grade
Sensible 245.0 BTU/hr	Perimeter 0.0 ft
Latent 205.0 BTU/hr	Slab Floor Area: 710.0 sqft
OTHER LOADS	Floor R-Value 2.40
Equipment: 0.00 W/sqft	Insulation R-value: 0.00
Misc. Sensible: 3000.0 BTU/hr	
Misc. Latent: 0.0 BTU/hr	
=======================================	=======================================
No external wall or window data for t	his space.
=======================================	
ROOF Slope Gross Area ROOF S	·
Exp (deg) (sqft)   Type   Ty	pe Qty
HOR - 710.0   1	
HOR - 710.0   1	2 0
No partition data for this space.	
-	

Prepared by: EINHOR	N YAFFEE	PRESCO'	ΓT					12-30-94
HAP v3.04								Page 1
********************								
GENERAL				CHEDULES				
Name: AHU 5	Acivity R	oom	3	Lighting	<b>j</b> :	Lights	\$	
Floor Area:	3545.0			rask Lig	jhts.:	Lights	3	
Building Weight.:	70.0	lb/sq	ft :	People.	:	Assemb	oly Spac	ces
Windows Shaded?	N		]	Equipmer	ıt:	People	<b>:</b>	
Partitions Used.?	N		I	Misc. Se	ens:	People	<u> </u>	
LIGHTING			I	Misc. La	atent:	People	2	
Overhead Fixture:	Recessed		I	NFILTRAT	CION			
Lamp Wattage:	2.80	W/sqf	t (	Cooling	:	C	.00 CFN	M/sqft
Ballast Mult:	1.00		]	Heating	:	C	.00 CF	M/sqft
Task Lighting:	0.00	W/sqf	t '	Typical	:	C	.00 CF	1/saft
PEOPLE		•		When Far			N	· -
Occupancy:	177.0	sqft/	per F	LOOR				
Activity Level:				Гуре	: S	lab Or	Grade	
Sensible:		BTU/h		Perimete				200.0 ft
Latent:		BTU/h		Slab Flo	or Are	a	:	3545.0 sqft
OTHER LOADS		•		Floor R				2.40
Equipment:	4500.0	W		Insulat				0.00
Misc. Sensible:	0.0							
Misc. Latent:		BTU/h						
=======================================			- =====:			=====	.=====:	
WALL Gross Area	WALL	W	INDOW		W	INDOW		Any
Exp (sqft)	Туре	Type	Qty	Shade	Туре	Qty	Shade	Doors?
W 152.0	1	1	0	-	1	0	-	N
E 1510.0	1	1	510	-	1	0	-	N
NW 385.0	1	1	0	=	1	0	-	N
N 290.0	1	1	0	-	1	0	-	N
S 476.0	1	1	0	-	1	0	-	N
-	s Area	ROOF	1	LIGHT				
Exp (deg)	(sqft)	Туре	Туре	Qty				
HOR -	3545.0	1	1 2	0	] 			
nor -			1	=	1 =======	=====	.=====	
No partition data f	or this s	pace.						

Prepared by: EINHORN YAFFEE HAP v3.04	PRESCOTT	12-30-94 Page 1
********	****	**********
GENERAL	SCHEDULE	2S
Name: AHU 6 Travel /	Kitchen Lightir	ng: Lights
Floor Area: 2048.0	sqft Task Li	.ghts.: Lights
Building Weight.: 70.0	lb/sqft People.	: People
Windows Shaded? N		ent: People
Partitions Used.? Y		Sens: People
LIGHTING		atent: People
Overhead Fixture: Recessed	INFILTRA	=
Lamp Wattage: 2.80	W/sqft Cooling	J: 0.00 CFM/sqft
Ballast Mult: 1.00		0.00 CFM/sqft
		0.00 CFM/sqft
PEOPLE		an On.?
Occupancy: 165.0	sqft/per FLOOR	
Activity Level: Office Wo	rk Type	:Slab On Grade
Sensible: 245.0	BTU/hr Perimet	er 0.0 ft
Latent 205.0	BTU/hr Slab Fl	oor Area 992.0 sqft
OTHER LOADS		R-Value 2.40
Equipment: 0.0	W Insulat	ion R-value: 0.00
Misc. Sensible: 5000.0	BTU/hr	
Misc. Latent: 0.0	-	
WALL Gross Area   WALL	WINDOW	WINDOW   Any
Exp (sqft) Type	Type Qty Shade	Type Qty Shade   Doors?
N 325.0   1	1 0 -	1 0 - N
	ROOF   SKYLIGHT	·
Exp (deg) (sqft)	ROOF   SKYLIGHT Type   Type Qty	
Exp (deg) (sqft)	ROOF   SKYLIGHT Type   Type Qty	
Exp (deg) (sqft)   HOR - 2048.0	ROOF   SKYLIGHT Type   Type Qty	
Exp (deg) (sqft)   HOR - 2048.0	ROOF   SKYLIGHT Type   Type Qty  1   2 0	
Exp (deg) (sqft)    HOR - 2048.0    PARTITION LOADS T	ROOF   SKYLIGHT Type   Type Qty  1   2 0  Type 1	 
Exp (deg) (sqft)    HOR - 2048.0    PARTITION LOADS T	ROOF   SKYLIGHT Type   Type Qty  1   2 0  Type 1	Type 2
Exp (deg) (sqft)    HOR - 2048.0    PARTITION LOADS T  Type. : Part	ROOF   SKYLIGHT Type   Type Qty  1   2 0  Type 1  Tition	Type 2  Ceiling
Exp (deg) (sqft)    HOR - 2048.0    PARTITION LOADS T  Type. : Part Area. :	ROOF   SKYLIGHT Type   Type Qty  1   2 0  Type 1  Sition 345.0 sqft	Type 2  Ceiling 0.0 sqft
Exp (deg) (sqft)    HOR - 2048.0    PARTITION LOADS T  Type Part Area	ROOF   SKYLIGHT Type   Type Qty  1   2 0  ype 1  ition 345.0 sqft 0.080 BTU/hr/sqft,	Type 2  Ceiling 0.0 sqft 0.500 BTU/hr/sqft/F
Exp (deg) (sqft)    HOR - 2048.0    PARTITION LOADS T  Type	ROOF   SKYLIGHT Type   Type Qty  1   2 0  Type 1  Tition 345.0 sqft 0.080 BTU/hr/sqft, 95.0 F	Type 2  Ceiling 0.0 sqft /F 0.500 BTU/hr/sqft/F 75.0 F
Exp (deg) (sqft)    HOR - 2048.0    PARTITION LOADS T  Type	ROOF   SKYLIGHT Type   Type Qty  1   2 0  Type 1  Tition 345.0 sqft 0.080 BTU/hr/sqft, 95.0 F 95.0 F	Type 2  Ceiling
Exp (deg) (sqft)    HOR - 2048.0    PARTITION LOADS T  Type	ROOF   SKYLIGHT Type   Type Qty  1   2 0  Type 1  Tition 345.0 sqft 0.080 BTU/hr/sqft, 95.0 F	Type 2  Ceiling 0.0 sqft /F 0.500 BTU/hr/sqft/F 75.0 F

Name: AHU-1 Baseline Type: CONSTANT VOLUME - Single Zone Prepared by: EINHORN YAFFEE PRESCO	
1. SYSTEM NAME AND TYPE	
Name: AHU-1 Baseline Type: CONSTANT VOLUMI Number of Zones.: 1	9
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Is Central Cooling Used?	Y
Supply Air:	55.0 F
Coil Bypass Factor:	0.100
Fan Cycled for Cooling?	N
Supply Air Reset:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used?	Y
Fan Cycled for Heating?	N National
Supply Air Reset OUTDOOR VENTILATION DATA	Not Used
	Constant Airflow Rate
Design Ventilation Airflow:	2135.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain:	2 %
Duct Leakage Rate:	5 %
RETURN PLENUM DATA	<u></u>
Is a Return Plenum Used?	N
SUPPLY FAN DATA	Designed Total for A co. 2 (v.5.)
Fan Type:	Backward Inclined or Airfoil
Configuration:	Draw-Thru
Fan Total Static:	2.00 in.wg.
Fan Efficiency	54 %
RETURN FAN DATA	Backward Inclined or Airfoil
Fan Type Fan Total Static	0.25 in.wg.
Fan Efficiency:	54 %
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	None
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used?	N
HUMIDIFICATION	
Humidification System Used?	N
DEHUMIDIFICATION	
Dehumidification System Used?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type:	None
SAFETY FACTORS	
Sensible Cooling Factor:	0 %
Latent Cooling Factor:	0 %
Heating Factor:	0 %

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AIK	SISIEM IMPOI DATA	
Name: AHU-1 Baseline		08-15-95
Type: CONSTANT VOLUME - Single	e Zone CAV	HAP v3.04
Prepared by: EINHORN YAFFEE PR	RESCOTT	Page 2
********	*******	******
3. ZONE DATA		
ZONE	1 (All Zones	the Same)
T-Stat Occupied Cooling(F)	: 75.0	- •
Unoccupied Cooling(F)		
Occupied Heating(F)		
Unoccupied Heating(F)		
Throttling Range(F)		
Zone Heating Unit Type		
Trip Temperature(F)		
Design Supply Temperature(F)		
Fan Total Static(in.wg.)		
Fan Efficiency(%)		
Zone Terminal Type		
Reheat Coil		
Direct Exhaust Airflow(CFM)		
Direct Exhaust Fan kW(kW)	: 0.0	
4. SCHEDULE DATA		
	0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1	
0 1 2	2 3 4 5 6 7 8 9 0 1 2 3 4 5	6 7 8 9 0 1 2 3
- · · · · ·	x x x x x x x x x x x x x x x	
Weekday  X X X	x x x x x x x x x x x x x x x	X X X X X X X X
Saturday  X X X	x x x x x x x x x x x x x x	X X X X X X X X
Sunday   X   X   X	x x x x x x x x x x x x x x	X X X X X X X X
=======================================		
Cooling Available During Unoco	cupied Period ? Y	
=======================================		
MONTHLY SCHEDULES   JAN   F	FEB   MAR   APR   MAY   JUN   JUL   AUG	SEP OCT NOV DEC
Space/Skin Heating   XXX   X	xxx xxx xxx	XXX   XXX   XXX
- , ,	(XX   XXX   XXX	XXX   XXX   XXX
Central Cooling	xxx   xxx   xxx   xxx   xxx   xxx	XXX   XXX   XXX
<u> </u>		

Name: AHU-2 Baseline Type: CONSTANT VOLUME - Multizone Prepared by: EINHORN YAFFEE PRESCO	12-30-94 HAP v3.04
	!"I'
1. SYSTEM NAME AND TYPE	
Name: AHU-2 Baseline Type: CONSTANT VOLUMN Number of Zones.: 3	
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Cold Deck Temperature:	55.0 F
Coil Bypass Factor:	
Cold Deck Reset:	
HEATING SYSTEM DATA	110 0 E
Hot Deck Temperature:	110.0 F
Hot Deck Reset	Not Used
Type of Control:	Constant Airflow Rate
Design Ventilation Airflow:	4300.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain:	2 %
Duct Leakage Rate:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used?	N
SUPPLY FAN DATA	
Fan Type:	Forward Curved
Fan Total Static:	2.00 in.wg.
Fan Efficiency:	54 %
RETURN FAN DATA	
Fan Type:	
Fan Total Static:	0.25 in.wg.
Fan Efficiency:	54 %
OUTDOOR AIR ECONOMIZER	None
Outdoor Economizer Type:	None
PREHEAT COIL Preheat Coil Used?	N
PRECOOL COIL	N
Precool Coil Used?	N
VENTILATION HEAT RECLAIM	••
Reclaim Unit Type:	None
SAFETY FACTORS	
Sensible Cooling Factor:	0 %
Latent Cooling Factor:	0 %
Heating Factor:	0 %
=======================================	=======================================

Name: AHU-2 Baseline 08-15-95 Type: CONSTANT VOLUME - Multizone HAP v3.04 Prepared by: EINHORN YAFFEE PRESCOTT 3. ZONE DATA ZONE 1 (All Zones the Same) T-Stat Occupied Cooling....(F): 75.0 Unoccupied Cooling..(F): 85.0 Occupied Heating....(F): 70.0 Unoccupied Heating..(F): 55.0 Throttling Range....(F): 3.0 Zone Heating Unit Type....: None Trip Temperature.....(F): Design Supply Temperature(F): Fan Total Static....(in.wg.): Fan Efficiency.....(%): Zone Terminal Type..... CAV MBox Reheat Coil....? N Diversity Factor....(%): 100 Direct Exhaust Airflow...(CFM): 200.0 Direct Exhaust Fan kW....(kW): 0.1 4. SCHEDULE DATA 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 \_\_\_\_\_\_ Cooling Available During Unoccupied Period ? Y MONTHLY SCHEDULES | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | \_\_\_\_\_\_ Central Heating..... | XXX | X Central Cooling..... | | | XXX 

Name: AHU-3 Baseline Type: CONSTANT VOLUME - Single Zone Prepared by: EINHORN YAFFEE PRESCO' ************************************	
1. SYSTEM NAME AND TYPE	
Name: AHU-3 Baseline Type: CONSTANT VOLUM Number of Zones.: 1	•
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Is Central Cooling Used?	Y
Supply Air	55.0 F
Coil Bypass Factor:	0.100
Fan Cycled for Cooling?	N
Supply Air Reset:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used?	Y
Fan Cycled for Heating?	N
Supply Air Reset	Not Used
	Constant Airflow Rate
Design Ventilation Airflow:	720.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate:	2 %
SUPPLY DUCT DATA	2 %
Duct Heat Gain	5 %
RETURN PLENUM DATA	2 %
Is a Return Plenum Used?	N
SUPPLY FAN DATA	
Fan Type:	Backward Inclined or Airfoil
Configuration:	Draw-Thru
Fan Total Static:	1.50 in.wg.
Fan Efficiency	54 %
RETURN FAN DATA	
Fan Type:	Backward Inclined or Airfoil
Fan Total Static	0.25 in.wg. 54 %
Fan Efficiency	J <del>1</del>
Outdoor Economizer Type:	None
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used?	N
HUMIDIFICATION	
Humidification System Used?	N
DEHUMIDIFICATION	NT.
Dehumidification System Used? VENTILATION HEAT RECLAIM	N
	None
Reclaim Unit TypeSAFETY FACTORS	1.01.0
Sensible Cooling Factor:	0 %
Latent Cooling Factor:	0 %
Heating Factor:	0 %
=======================================	

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Name: AHU-3 Baseline	08-15-95
Type: CONSTANT VOLUME - Single Zon	
Prepared by: EINHORN YAFFEE PRESCO	
	**********************************
3. ZONE DATA	
ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling(F):	75.0
Unoccupied Cooling(F):	85.0
Occupied Heating(F):	70.0
Unoccupied Heating(F):	55.0
Throttling Range(F):	3.0
Zone Heating Unit Type:	Skin BB
Trip Temperature(F):	35.0
Design Supply Temperature(F):	-
Fan Total Static(in.wg.):	-
Fan Efficiency(%):	-
Zone Terminal Type:	Diffuser
Reheat Coil?	N
Direct Exhaust Airflow(CFM):	900.0
Direct Exhaust Fan kW(kW):	0.1
4. SCHEDULE DATA	
=======================================	
HOURLY TSTAT SCHEDULES  0 0 0 0	0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 2 2 2 2
0 1 2 3 4	1   5   6   7   8   9   0   1   2   3   4   5   6   7   8   9   0   1   2   3
Design Day  X X X X	x   x   x   x   x   x   x   x   x   x
	x   x   x   x   x   x   x   x   x   x
Saturday   X   X   X   X   X	x   x   x   x   x   x   x   x   x   x
Sunday   X   X   X   X   X   X	x   x   x   x   x   x   x   x   x   x
=======================================	
Cooling Available During Unoccupie	ed Period ? Y
MONTHLY SCHEDULES   JAN   FEB   1	MAR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC
Conso (chin Hosting   vvv vvv	xxx xxx            xxx xxx xxx
Space/Skin Heating   XXX   XXX	
	XXX   XXX
Central Cooting	

Name: AHU-4 Baseline	12-30-94				
Type: CONSTANT VOLUME - Multizone	HAP v3.04				
Prepared by: EINHORN YAFFEE PRESCOTT Pag					
	**********				
1. SYSTEM NAME AND TYPE					
Name AHU-4 Baseline					
Type CONSTANT VOLUM	E - Multizone				
Number of Zones.: 7					
	=======================================				
2. SYSTEM DESCRIPTION					
COOLING SYSTEM DATA					
Cold Deck Temperature:	55.0 F				
-1 P	0.100				
	Not Used				
HEATING SYSTEM DATA	110.0 F				
Hot Deck Temperature	Not Used				
OUTDOOR VENTILATION DATA	NOC USED				
Type of Control:	Constant Airflow Rate				
Design Ventilation Airflow:	2160.0 CFM				
Dampers Open During Unocc Per.:	N				
Damper Leak Rate:	2 %				
SUPPLY DUCT DATA					
Duct Heat Gain:	2 %				
Duct Leakage Rate:	5 %				
RETURN PLENUM DATA					
Is a Return Plenum Used?	N				
SUPPLY FAN DATA					
Fan Type:					
Fan Total Static:	1.50 in.wg.				
Fan Efficiency:	54 %				
RETURN FAN DATA	produced realization relations				
Fan Type:					
Fan Total Static	0.25 in.wg. 54 %				
Fan Efficiency:	24 %				
OUTDOOR AIR ECONOMIZER Outdoor Economizer Type:	None				
PREHEAT COIL	None				
Preheat Coil Used?	N				
PRECOOL COIL					
Precool Coil Used?	N				
VENTILATION HEAT RECLAIM					
Reclaim Unit Type:	None				
SAFETY FACTORS					
Sensible Cooling Factor:	0 %				
Latent Cooling Factor:	0 %				
Heating Factor	0 %				
	=======================================				

Name: AHU-4 Baseline	08-15-95
Type: CONSTANT VOLUME - Multizone	HAP v3.04
Prepared by: EINHORN YAFFEE PRESCO	TT Page 2
********	***********
3. ZONE DATA	
ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling(F):	75.0
Unoccupied Cooling(F):	85.0
Occupied Heating(F):	70.0
Unoccupied Heating(F):	55.0
Throttling Range(F):	3.0
Zone Heating Unit Type:	None
Trip Temperature(F):	-
Design Supply Temperature(F):	-
Fan Total Static(in.wg.):	-
Fan Efficiency(%):	-
Zone Terminal Type:	CAV MBox
Reheat Coil?	N
Diversity Factor(%):	100
Direct Exhaust Airflow(CFM):	0.0
Direct Exhaust Fan kW(kW):	0.0
*************************	
A GOVERNI E DAMA	
4. SCHEDULE DATA	
	0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 2 2 2 2
	5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3
Design Day  X X X X	$ \mathbf{x} \mathbf{x} \mathbf{x} \mathbf{x} \mathbf{x} \mathbf{x} \mathbf{x} \mathbf{x}$
	x
=======================================	
Cooling Available During Unoccupie	
	IAR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC
Central Heating   XXX   XXX   X	
Central Cooling   X	

Name: AHU-5 Baseline Type: CONSTANT VOLUME - Single Zon Prepared by: EINHORN YAFFEE PRESCO	
1. SYSTEM NAME AND TYPE	
Name: AHU-5 Baseline Type: CONSTANT VOLUM Number of Zones.: 1	
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Is Central Cooling Used?	Y
Supply Air:	55.0 F
Coil Bypass Factor:	0.100
Fan Cycled for Cooling?	N
Supply Air Reset:	Not Used
HEATING SYSTEM DATA Is Central Heating Used?	Y
Fan Cycled for Heating?	N
Supply Air Reset:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control	
Design Ventilation Airflow: Dampers Open During Unocc Per.:	960.0 CFM N
Damper Leak Rate	2 %
SUPPLY DUCT DATA	2 0
Duct Heat Gain:	2 %
Duct Leakage Rate:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used? SUPPLY FAN DATA	N
Fan Type:	Forward Curved
Configuration:	Draw-Thru
Fan Total Static:	1.50 in.wg.
Fan Efficiency:	54 %
RETURN FAN DATA	produced realisate or placed
Fan Type  Fan Total Static	Backward Inclined or Airfoil 0.25 in.wg.
Fan Efficiency:	54 %
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	None
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	NT.
Precool Coil Used? HUMIDIFICATION	N
Humidification System Used?	И
DEHUMIDIFICATION	<del>-</del> -
Dehumidification System Used?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type:	None
SAFETY FACTORS	0 %
Sensible Cooling Factor: Latent Cooling Factor:	0 % 0 %
- Daren Con Con Div 8401.01	u n

ZONE DATA  ZONE 1 (All Zones the Same)  T-Stat Occupied Cooling(F): 75.0     Unoccupied Meating(F): 85.0     Occupied Heating(F): 70.0     Unoccupied Heating(F): 55.0     Throttling Range(F): 3.0  Zone Heating Unit Type Skin BB  Trip Temperature(F): 35.0 Design Supply Temperature(F): - Fan Total Static(in.wg): - Fan Efficiency(%): - Zone Terminal Type Diffuser Reheat Coil	Name: AHU-5 Baseline Type: CONSTANT VOLUME - Sing Prepared by: EINHORN YAFFEE	PRESC	one (	CAV			***	***	***		HAP v Pag	_
T-Stat Occupied Cooling. (F): 75.0     Unoccupied Cooling. (F): 85.0     Occupied Heating. (F): 70.0     Unoccupied Heating. (F): 55.0     Throttling Range. (F): 3.0  Zone Heating Unit Type. Skin BB  Trip Temperature. (F): 35.0  Design Supply Temperature(F): - Fan Total Static. (in.wg.): - Fan Efficiency. (%): - Zone Terminal Type. Diffuser Reheat Coil. ? N Direct Exhaust Airflow. (CFM): 0.0 Direct Exhaust Fan kW. (kW): 0.0	3. ZONE DATA											
T-Stat Occupied Cooling. (F): 75.0     Unoccupied Cooling. (F): 85.0     Occupied Heating. (F): 70.0     Unoccupied Heating. (F): 55.0     Throttling Range. (F): 3.0  Zone Heating Unit Type. Skin BB  Trip Temperature. (F): 35.0  Design Supply Temperature(F): - Fan Total Static. (in.wg.): - Fan Efficiency. (%): - Zone Terminal Type. Diffuser Reheat Coil. ? N Direct Exhaust Airflow. (CFM): 0.0 Direct Exhaust Fan kW. (kW): 0.0												
Unoccupied Heating(F): 70.0 Unoccupied Heating(F): 70.0 Unoccupied Heating(F): 55.0 Throttling Range(F): 3.0 Zone Heating Unit Type: Skin BB Trip Temperature(F): 35.0 Design Supply Temperature(F): - Fan Total Static(in.wg.): - Fan Efficiency(%): - Zone Terminal Type: Diffuser Reheat Coil? N Direct Exhaust Airflow(CFM): 0.0 Direct Exhaust Fan kW(kW): 0.0						(Al	l Zoı	nes t	the :	Same	)	
Occupied Heating(F): 70.0 Unoccupied Heating(F): 55.0 Throttling Range(F): 3.0  Zone Heating Unit Type: Skin BB Trip Temperature(F): 35.0 Design Supply Temperature(F): - Fan Total Static(in.wg.): - Fan Efficiency(%): - Zone Terminal Type: Diffuser Reheat Coil? N Direct Exhaust Airflow(CFM): 0.0 Direct Exhaust Fan kW(kW): 0.0  ### HOURLY TSTAT SCHEDULES   0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2				-								
Unoccupied Heating.(F): 55.0 Throttling Range(F): 3.0  Zone Heating Unit Type: Skin BB  Trip Temperature(F): 35.0  Design Supply Temperature(F): - Fan Total Static(in.wg.): - Fan Efficiency(*): - Zone Terminal Type Diffuser Reheat Coil? N  Direct Exhaust Airflow(CFM): 0.0  Direct Exhaust Fan kW(kW): 0.0	<del>-</del>											
Throttling Range (F): 3.0  Zone Heating Unit Type: Skin BB  Trip Temperature (F): 35.0  Design Supply Temperature (F): - Fan Total Static (in.wg.): - Fan Efficiency Diffuser Reheat Coil N Direct Exhaust Airflow (CFM): 0.0  Direct Exhaust Fan kW (kW): 0.0	<del>-</del>											
Zone Heating Unit Type	<u> </u>											
Trip Temperature(F): 35.0  Design Supply Temperature(F): - Fan Total Static(in.wg.): - Fan Efficiency												
Design Supply Temperature(F): Fan Total Static(in.wg.): Fan Efficiency(%): Zone Terminal Type	<del>-</del>											
Fan Total Static(in.wg.):				ے د	,							
Fan Efficiency(%): Zone Terminal Type: Diffuser Reheat Coil? N Direct Exhaust Airflow(CFM): 0.0 Direct Exhaust Fan kW(kW): 0.0  4. SCHEDULE DATA  HOURLY TSTAT SCHEDULES   0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 2 2 2 2					_							
Diffuser					_							
Reheat Coil	<del>-</del>		Di	ffus	er							
Direct Exhaust Fan kW(kW): 0.0												
Direct Exhaust Fan kw(kw): 0.0  4. SCHEDULE DATA  HOURLY TSTAT SCHEDULES   0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1				(								
4. SCHEDULE DATA  HOURLY TSTAT SCHEDULES   0   0   0   0   0   0   0   1   1   1												
HOURLY TSTAT SCHEDULES   0   0   0   0   0   0   0   0   1   1		.====	-===	====	====	====	====:	====	====	====:	====	
HOURLY TSTAT SCHEDULES	4. SCHEDULE DATA											
O   1   2   3   4   5   6   7   8   9   0   1   2   3   4   5   6   7   8   9   0   1   2   3				====	====	====	====:	====:		====	====	
Design Day	HOURLY TSTAT SCHEDULES   0   0	000	0 0	0 0	0 0	111	111	1   1	111	111	2 2	2   2
Weekday	0 1	. 2 3	4 5	6 7	8   9	0 1	2 3	4   5	6 7	8 9	0 1	2 3
Weekday												
Saturday												
Sunday												
Cooling Available During Unoccupied Period ? Y  MONTHLY SCHEDULES   JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC   Space/Skin Heating   XXX XXX XXX          XXX XXX XXX  Central Heating   XXX XXX XXX          XXX XXX XXX  Central Cooling     XXX XXX XXX XXX XXX XXX XXX	_ , ,											
Cooling Available During Unoccupied Period ? Y  MONTHLY SCHEDULES   JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC   Space/Skin Heating   XXX XXX XXX            XXX XXX XXX					•							
MONTHLY SCHEDULES   JAN   FEB   MAR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC    Space/Skin Heating   XXX   XXX	Cooling Available During Unc	ccup	ied I	Perio	od ?	Y						
Space/Skin Heating           XXX   X												
Space/Skin Heating           XXX   X	· · · · · · · · · · · · · · · · · · ·	•	MAR	APR	MAY	JUN	lwr	AUG	SEP	OCT	NON	DEC
Central Heating   XXX   X			   323232	   323232	- <b>-</b>	·	·	·		   122222	 1 ******	
Central Cooling			•	•		1	ļ 1	į i	•		•	
	. =	•	•	•		   vvv	   vvv	   vvv			•	
	<del>-</del>	•	•	•		•	•	•	•	•	•	

Name: AHU-6 Baseline	12-30-94			
Type: CONSTANT VOLUME - Single Zor				
Prepared by: EINHORN YAFFEE PRESCO				
********************				
1. SYSTEM NAME AND TYPE				
Name AHU-6 Baseline				
Type CONSTANT VOLUM	ME - Single Zone CAV			
Number of Zones.: 1	3			
	=======================================			
2. SYSTEM DESCRIPTION				
COOLING SYSTEM DATA				
Is Central Cooling Used?	N			
HEATING SYSTEM DATA				
Supply Air Temperature?	110.0 F			
Fan Cycled for Heating?	N			
Supply Air Reset:	Not Used			
OUTDOOR VENTILATION DATA				
Type of Control:	Constant Airflow Rate			
Design Ventilation Airflow:	100 %			
Dampers Open During Unocc Per.:	N			
Damper Leak Rate:	2 %			
SUPPLY DUCT DATA				
Duct Heat Gain:	2 %			
Duct Leakage Rate:	5 %			
RETURN PLENUM DATA				
Is a Return Plenum Used?	N			
SUPPLY FAN DATA				
Fan Type:	Forward Curved			
Configuration:	Draw-Thru			
Fan Total Static:	1.00 in.wg.			
Fan Efficiency:	54 %			
RETURN FAN DATA				
Fan Type:	None			
OUTDOOR AIR ECONOMIZER				
Outdoor Economizer Type:	None			
PREHEAT COIL				
Preheat Coil Used?	N			
PRECOOL COIL				
Precool Coil Used?	N			
HUMIDIFICATION				
Humidification System Used?	N			
VENTILATION HEAT RECLAIM				
Reclaim Unit Type:	None			
SAFETY FACTORS				
Sensible Cooling Factor:	0 %			
Latent Cooling Factor:	0 %			
Heating Factor:	0 %			

C-35

Name: AHU-6 Baseline Type: CONSTANT VOLUME - S Prepared by: EINHORN YAFI	FEE I	PRES	COTT		***	***	****	***	***		08-1 IAP v Pag	3.04 e 2
3. ZONE DATA												
ZONE					1	 (Al	l Zoi	nes i	the	 Same)		
T-Stat Occupied Cooling.	( I	· :		7	5.0							
Unoccupied Cooling				8.	5.0							
Occupied Heating.	-				0.0							
Unoccupied Heating				5!	5.0							
Throttling Range.					3.0							
Zone Heating Unit Type				Skin	BB							
Trip Temperature				3	5.0							
Design Supply Temperatu					-							
Fan Total Static(in					_							
Fan Efficiency					-							
Zone Terminal Type		:	D	iffu	ser							
Reheat Coil					N							
Direct Exhaust Airflow	. (CFN	1) :		540	0.0							
Direct Exhaust Fan kW	(k	: (V		;	1.4							
=		====	====	====	====	====	====	====	====	=====	====	====
4. SCHEDULE DATA				====								
		1010	lolo	lolo	lolo	1111	1111	1111	  1 1	111	2 2 2 1	2 2
										8 9		
Design Day	x x	x x	x x	$ \mathbf{x} \mathbf{x}$	x x	x x	x x	x   x	x   x	$ \mathbf{x} \mathbf{x}$	x x	x   x
Weekday												
Saturday												
Sunday	x x	x x	$ \mathbf{x} \mathbf{x}$	$ \mathbf{x} \mathbf{x}$	$ \mathbf{x} \mathbf{x}$	$ \mathbf{x} \mathbf{x}$	x x	xx	x x	$ \mathbf{x} \mathbf{x}$	$ \mathbf{x} \mathbf{x} $	$\mathbf{x}   \mathbf{x}$
MONTHLY SCHEDULES												
Space/Skin Heating										xxx	,	XXX
Central Heating	•	•	,	•	•	•	•	•		XXX		

	M INPUT DATA
Name: AHU-1 PLC	12-30-94
Type: CONSTANT VOLUME - Single Zone	
Prepared by: EINHORN YAFFEE PRESCOT	
**********	************
1. SYSTEM NAME AND TYPE	
Name: AHU-1 PLC	
Type CONSTANT VOLUME	E - Single Zone CAV
Number of Zones.: 1	
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	V
Is Central Cooling Used?	Y
Supply Air	55.0 F
Coil Bypass Factor:	0.100
Fan Cycled for Cooling?	N
Supply Air Reset:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used?	Y
Fan Cycled for Heating?	N
Supply Air Reset:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control:	Constant Airflow Rate
Design Ventilation Airflow:	2135.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain	2 %
Duct Leakage Rate:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used?	N
SUPPLY FAN DATA	
Fan Type:	Backward Inclined or Airfoil
Configuration:	Draw-Thru
Fan Total Static:	2.00 in.wg.
Fan Efficiency:	54 %
RETURN FAN DATA	
Fan Type:	Backward Inclined or Airfoil
Fan Total Static:	0.25 in.wg.
Fan Efficiency:	54
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	None
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used?	N
HUMIDIFICATION	
Humidification System Used?	N
DEHUMIDIFICATION -	
Dehumidification System Used?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type:	None
SAFETY FACTORS	
Sensible Cooling Factor:	0 %
Latent Cooling Factor:	0 %
Heating Factor:	0 %
=======================================	

Name: AHU-1 PLC Type: CONSTANT VOLUME - Single Zo: Prepared by: EINHORN YAFFEE PRESC		12-30-94 HAP v3.04	
***********		*****	Page 2
3. ZONE DATA			
ZONE	1	(All Zones t	the Same)
T-Stat Occupied Cooling(F):	75.0		• •
Unoccupied Cooling(F):	85.0		
Occupied Heating(F):	70.0		
Unoccupied Heating(F):	55.0		
Throttling Range $(F)$ :	3.0		
Zone Heating Unit Type:	Skin BB		
Trip Temperature(F):	35.0		
Design Supply Temperature(F):	-		
Fan Total Static(in.wg.):	-		
Fan Efficiency(%):	- Diffuser		
Zone Terminal Type?	Diffusel		
Direct Exhaust Airflow(CFM):	0.0		
Direct Exhaust Fan kW(kW):	0.0		
		=========	=========
4. SCHEDULE DATA			
			1 1 1 1 2 2 2 2 2
[0]1[2]3]	4 5 6 7 8 9	0 1 2 3 4 5	6 7 8 9 0 1 2 3
Design Day	x x x	x x x x x x x	
Weekday			X   X   X   X   X   X   X
Saturday			X   X   X   X   X   X   X
Sunday		$ \mathbf{x} \mathbf{x} \mathbf{x} \mathbf{x} \mathbf{x} \mathbf{x}$	
2			=======================================
Cooling Available During Unoccupi	ed Period ?	N	
		==========	
MONTHLY SCHEDULES   JAN   FEB	mar   apr   may	JUN JUL AUG	SEP OCT NOV DEC
G / Glade		1 1 1 1	
Space/Skin Heating   XXX   XXX	: :		XXX XXX XXX
Central Heating   XXX   XXX   Central Cooling	! !	xxx xxx xxx	XXX XXX XXX XXX
central cooring			

Name: AHU-2 PLC Type: CONSTANT VOLUME - Multizone Prepared by: EINHORN YAFFEE PRESCO	12-30-94 HAP v3.04 TT Page 1
1. SYSTEM NAME AND TYPE	
Name: AHU-2 PLC Type: CONSTANT VOLUMI Number of Zones.: 3	E - Multizone
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	EE 0 E
Cold Deck Temperature: Coil Bypass Factor:	55.0 F 0.100
Cold Deck Reset:	
HEATING SYSTEM DATA	Not obed
Hot Deck Temperature:	110.0 F
Hot Deck Reset:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control:	Constant Airflow Rate
Design Ventilation Airflow:	4300.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain:	2 %
Duct Leakage Rate:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used?	N
SUPPLY FAN DATA	Tanada Garaga
Fan Type:	
Fan Total Static:	2.00 in.wg. 54 %
Fan Efficiency RETURN FAN DATA	<b>34.</b> %
Fan Type:	Backward Inclined or Airfoil
Fan Total Static:	0.25 in.wg.
Fan Efficiency:	54 %
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	None
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type:	None
SAFETY FACTORS	0. %
Sensible Cooling Factor:	0 % 0 %
Latent Cooling Factor: Heating Factor	0 %
======================================	=======================================

Name: AHU-2 PLC 12-30-94 Type: CONSTANT VOLUME - Multizone HAP v3.04 Prepared by: EINHORN YAFFEE PRESCOTT Page 2 \* 3. ZONE DATA ZONE 1 (All Zones the Same) T-Stat Occupied Cooling....(F): 75.0 Unoccupied Cooling..(F): 85.0 Occupied Heating....(F): 70.0 55.0 Unoccupied Heating..(F): Throttling Range....(F): 3.0 Zone Heating Unit Type....: None Trip Temperature.....(F): Design Supply Temperature(F): Fan Total Static....(in.wg.): Fan Efficiency.....(%): Zone Terminal Type....: Reheat Coil....? N Diversity Factor....(%): 100 Direct Exhaust Airflow...(CFM): 200.0 Direct Exhaust Fan kW....(kW): \_\_\_\_\_\_ 4. SCHEDULE DATA 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 Saturday..... | | | | | | Cooling Available During Unoccupied Period ? N \_\_\_\_\_\_ MONTHLY SCHEDULES | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | \_\_\_\_\_ To see the reese

	EM INPUT DATA		
Name: AHU-3 PLC	12-30-94		
Type: CONSTANT VOLUME - Single Zon	e CAV HAP v3.04		
Prepared by: EINHORN YAFFEE PRESCOTT Page			
	**********		
1. SYSTEM NAME AND TYPE			
Name: AHU-3 PLC			
Type CONSTANT VOLUM	E - Single Zone CAV		
Number of Zones.: 1			
	=======================================		
2. SYSTEM DESCRIPTION			
COOLING SYSTEM DATA			
Is Central Cooling Used?	Y		
Supply Air:	55.0 F		
Coil Bypass Factor:	0.100		
Fan Cycled for Cooling?	N		
	Not Used		
HEATING SYSTEM DATA			
Is Central Heating Used?	Y		
Fan Cycled for Heating?	N		
Supply Air Reset:	Not Used		
OUTDOOR VENTILATION DATA	Not obed		
	Constant Airfley Date		
Type of Control:	Constant Airflow Rate		
Design Ventilation Airflow:	720.0 CFM		
Dampers Open During Unocc Per.:	N		
Damper Leak Rate:	2 %		
SUPPLY DUCT DATA			
Duct Heat Gain:	2 %		
Duct Leakage Rate:	5 %		
RETURN PLENUM DATA			
Is a Return Plenum Used?	N		
SUPPLY FAN DATA			
Fan Type:	Backward Inclined or Airfoil		
Configuration:	Draw-Thru		
Fan Total Static:	1.50 in.wg.		
Fan Efficiency:	54 %		
RETURN FAN DATA			
Fan Type:	Backward Inclined or Airfoil		
Fan Total Static:	0.25 in.wg.		
Fan Efficiency:	54 %		
OUTDOOR AIR ECONOMIZER			
Outdoor Economizer Type:	None		
PREHEAT COIL			
Preheat Coil Used?	N		
PRECOOL COIL	**		
Precool Coil Used?	N		
	N		
HUMIDIFICATION	NT.		
Humidification System Used?	N		
DEHUMIDIFICATION			
Dehumidification System Used?	N		
VENTILATION HEAT RECLAIM			
Reclaim Unit Type:	None		
SAFETY FACTORS			
Sensible Cooling Factor:	0 %		
Latent Cooling Factor:	0 %		
Heating Factor	0 %		
_			

Name: AHU-3 PLC Type: CONSTANT VOLUME - Single Zo Prepared by: EINHORN YAFFEE PRESO ************************************	COTT	*****	12-30-94 HAP v3.04 Page 2
3. ZONE DATA			
ZONE	1	(All Zones	the Same)
T-Stat Occupied Cooling(F):	75.0		
Unoccupied Cooling(F):	85.0		
Occupied Heating(F):	70.0		
Unoccupied Heating(F):	55.0		
Throttling Range(F):	3.0		
Zone Heating Unit Type:	Skin BB		
Trip Temperature(F):	35.0		
Design Supply Temperature(F):	-		
Fan Total Static(in.wg.):	-		
Fan Efficiency(%):	-		
Zone Terminal Type:	Diffuser		
Reheat Coil?	N		
Direct Exhaust Airflow(CFM):	900.0		
Direct Exhaust Fan kW(kW):	0.1		
=======================================			==========
4. SCHEDULE DATA			
		=========	==========
			1   1   1   2   2   2   2     6   7   8   9   0   1   2   3
Design Day		1 1 1 1 1 1	X   X   X   X   X   X   X
Weekday			X   X   X   X   X   X   X
Saturday		1 1 1 1 1 1	X   X   X   X   X   X   X
Sunday		X X X X X X	X X X
Cooling Available During Unoccupi	led Period ?		==========
		=========	=======================================
MONTHLY SCHEDULES   JAN   FEB	MAR APR MAY 	JUN JUL AUG	SEP OCT NOV DEC
Space/Skin Heating   XXX   XXX	xxx		
Central Heating   XXX   XXX	i i i		XXX XXX XXX XXX
- : : :	! !	XXX XXX XXX	
	·	·	

Name: AHU-4 PLC	12-30-94
Type: CONSTANT VOLUME - Multizone	HAP v3.04
Prepared by: EINHORN YAFFEE PRESCO	
********	************
1. SYSTEM NAME AND TYPE	
Name AHU-4 PLC	
Type CONSTANT VOLUM	E - Multizone
Number of Zones.: 7	
=======================================	=======================================
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Cold Deck Temperature:	55.0 F
Coil Bypass Factor:	0.100
Cold Deck Reset:	Not Used
HEATING SYSTEM DATA	
Hot Deck Temperature:	110.0 F
Hot Deck Reset:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control:	
Design Ventilation Airflow:	2160.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate:	2 %
SUPPLY DUCT DATA	2 %.
Duct Heat Gain	2 % 5 %
Duct Leakage Rate RETURN PLENUM DATA	5 %
Is a Return Plenum Used?	N
SUPPLY FAN DATA	<b>^1</b>
Fan Type:	Forward Curved
Fan Total Static:	1.50 in.wg.
Fan Efficiency:	54 %
RETURN FAN DATA	
Fan Type:	Backward Inclined or Airfoil
Fan Total Static:	0.25 in.wg.
Fan Efficiency:	54 %
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	None
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used?	N
VENTILATION HEAT RECLAIM	\ <del>-</del>
Reclaim Unit Type:	None
SAFETY FACTORS	0 %
Sensible Cooling Factor:	0 % 0 %
Latent Cooling Factor Heating Factor	0 %

Name: AHU-4 PLC	12-30-94
Type: CONSTANT VOLUME - Multizone	HAP v3.04
Prepared by: EINHORN YAFFEE PRESC	OTT Page 2
********	***********
3. ZONE DATA	
ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling(F):	75.0
Unoccupied Cooling(F):	85.0
Occupied Heating(F):	70.0
Unoccupied Heating(F):	55.0
Throttling Range(F):	3.0
Zone Heating Unit Type:	None
Trip Temperature(F):	-
Design Supply Temperature(F):	-
Fan Total Static(in.wg.):	-
Fan Efficiency(%):	-
Zone Terminal Type:	CAV MBox
Reheat Coil?	N
Diversity Factor(%):	100
Direct Exhaust Airflow(CFM):	0.0
Direct Exhaust Fan kW(kW):	0.0
=======================================	
4. SCHEDULE DATA	
1 1 1 1	0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1
0 1 2 3	4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3
Design Day	
Weekday	
Saturday	
Sunday	
	=======================================
Cooling Available During Unoccupi	ed Period ? N
MONTHLY SCHEDULES   JAN   FEB	MAR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC
Central Heating XXX XXX	
Central Cooling	xxx   xxx   xxx   xxx   xxx   xxx   xxx

Name: AHU-5 PLC	12-30-94
Type: CONSTANT VOLUME - Single Zone	e CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCO	
	***********
1. SYSTEM NAME AND TYPE	
Name AHU-5 PLC	
Type CONSTANT VOLUME	E - Single Zone CAV
Number of Zones.: 1	•
=======================================	
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Is Central Cooling Used?	Y
Supply Air:	55.0 F
Coil Bypass Factor:	0.100
Fan Cycled for Cooling?	N
Supply Air Reset:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used?	Y
Fan Cycled for Heating?	N
Supply Air Reset:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control:	Constant Airflow Rate
Design Ventilation Airflow:	960.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain:	2 %
Duct Leakage Rate:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used?	N
SUPPLY FAN DATA	
Fan Type:	Forward Curved
Configuration:	Draw-Thru
Fan Total Static:	1.50 in.wg.
Fan Efficiency:	54 %
RETURN FAN DATA	
Fan Type:	Backward Inclined or Airfoil
Fan Total Static:	0.25 in.wg.
Fan Efficiency:	54 %
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	None
PREHEAT COIL	\ <del>-</del>
Preheat Coil Used?	N
PRECOOL COIL	<b>&gt;</b> *
Precool Coil Used?	N
HUMIDIFICATION	
Humidification System Used?	N
DEHUMIDIFICATION	N
Dehumidification System Used?	N
VENTILATION HEAT RECLAIM	None
Reclaim Unit Type	None
SAFETY FACTORS	0 %
Sensible Cooling Factor:  Latent Cooling Factor:	0 %
Heating Factor	0 %
======================================	=======================================

Name: AHU-5 PLC	AIR SY	STEM INPUT DA	ATA
Prepared by: EINHORN YAFFEE PRESCOTT			12-30-9
3. ZONE DATA  ZONE 1 (All Zones the Same)  T-Stat Occupied Cooling(F): 75.0  Unoccupied Heating(F): 75.0  Occupied Heating(F): 70.0  Unoccupied Heating(F): 70.0  Unoccupied Heating(F): 3.0  Zone Heating Unit Type Skin BB  Trip Temperature(F): 35.0  Design Supply Temperature(F): - Fan Total Static(in.wg.): - Fan Efficiency(%): - Zone Terminal Type Diffuser Reheat Coil? N  Direct Exhaust Airflow(CFM): 0.0  Direct Exhaust Fan kW(kW): 0.0			HAP v3.0
ZONE DATA  ZONE 1 (All Zones the Same)  T-Stat Occupied Cooling(F): 75.0	Prepared by: EINHORN YAFFEE PRES	COTT	Page
T-Stat Occupied Cooling(F): 75.0	*********	******	*******
T-Stat Occupied Cooling(F): 75.0			
T-Stat Occupied Cooling(F): 75.0     Unoccupied Cooling(F): 85.0     Occupied Heating(F): 70.0     Unoccupied Heating(F): 55.0     Throttling Range(F): 3.0  Zone Heating Unit Type: Skin BB  Trip Temperature(F): 35.0  Design Supply Temperature(F): - Fan Total Static(in.wg.): - Fan Efficiency	3. ZONE DATA		
T-Stat Occupied Cooling(F): 75.0     Unoccupied Cooling(F): 85.0     Occupied Heating(F): 70.0     Unoccupied Heating(F): 55.0     Throttling Range(F): 3.0  Zone Heating Unit Type: Skin BB  Trip Temperature(F): 35.0  Design Supply Temperature(F): - Fan Total Static(in.wg.): - Fan Efficiency			
Unoccupied Cooling.(F): 85.0 Occupied Heating(F): 70.0 Unoccupied Heating.(F): 55.0 Throttling Range(F): 3.0  Zone Heating Unit Type: Skin BB Trip Temperature(F): 35.0 Design Supply Temperature(F): - Fan Total Static(in.wg): - Fan Efficiency(%): - Zone Terminal Type: Diffuser Reheat Coil		1	(All Zones the Same)
Occupied Heating(F): 70.0     Unoccupied Heating(F): 55.0     Throttling Range(F): 3.0  Zone Heating Unit Type Skin BB     Trip Temperature(F): 35.0     Design Supply Temperature(F): -     Fan Total Static(in.wg.): -     Fan Efficiency(%): - Zone Terminal Type Diffuser     Reheat Coil? N Direct Exhaust Airflow(CFM): 0.0 Direct Exhaust Fan kW(kW): 0.0	<del>-</del>	75.0	
Unoccupied Heating(F): 55.0     Throttling Range(F): 3.0  Zone Heating Unit Type: Skin BB Trip Temperature(F): 35.0 Design Supply Temperature(F): - Fan Total Static(in.wg.): - Fan Efficiency(%): -  Zone Terminal Type: Diffuser Reheat Coil? N Direct Exhaust Airflow(CFM): 0.0 Direct Exhaust Fan kW(kW): 0.0		85.0	
Throttling Range(F): 3.0  Zone Heating Unit Type: Skin BB  Trip Temperature(F): 35.0  Design Supply Temperature(F): - Fan Total Static(in.wg.): - Fan Efficiency(%): -  Zone Terminal Type: Diffuser Reheat Coil? N Direct Exhaust Airflow(CFM): 0.0 Direct Exhaust Fan kW(kW): 0.0		70.0	
Zone Heating Unit Type: Skin BB     Trip Temperature	•	55.0	
Trip Temperature(F): 35.0  Design Supply Temperature(F): - Fan Total Static(in.wg.): - Fan Efficiency(%): - Zone Terminal Type Diffuser Reheat Coil? N  Direct Exhaust Airflow(CFM): 0.0  Direct Exhaust Fan kW(kW): 0.0	Throttling Range(F):	3.0	
Design Supply Temperature(F):     Fan Total Static(in.wg.):     Fan Efficiency(%):     Zone Terminal Type? Diffuser Reheat Coil? Direct Exhaust Airflow(CFM):     O.0 Direct Exhaust Fan kW(kW):     O.0	Zone Heating Unit Type:	Skin BB	
Fan Total Static(in.wg.): Fan Efficiency(%): Zone Terminal Type: Diffuser Reheat Coil? N Direct Exhaust Airflow(CFM): 0.0 Direct Exhaust Fan kW(kW): 0.0	Trip Temperature(F):	35.0	
Fan Efficiency	Design Supply Temperature(F):	-	
Zone Terminal Type	Fan Total Static(in.wg.):	-	
Reheat Coil	Fan Efficiency(%):	-	
Direct Exhaust Fan kW(kW): 0.0	Zone Terminal Type:	Diffuser	
Direct Exhaust Fan kW(kW): 0.0	Reheat Coil?	N	
4. SCHEDULE DATA  HOURLY TSTAT SCHEDULES   0   0   0   0   0   0   0   0   1   1	Direct Exhaust Airflow(CFM):	0.0	
4. SCHEDULE DATA	Direct Exhaust Fan kW(kW):	0.0	
HOURLY TSTAT SCHEDULES	=======================================		
HOURLY TSTAT SCHEDULES			
HOURLY TSTAT SCHEDULES	4. SCHEDULE DATA		
O   1   2   3   4   5   6   7   8   9   0   1   2   3   4   5   6   7   8   9   0   1   2   3			
Design Day			
Weekday	0 1 2 3	4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9 0 1 2 3
Weekday			
Saturday	Design Day		X   X   X   X   X   X   X   X   X   X
Sunday	Weekday		X   X   X   X   X   X   X   X   X   X
Cooling Available During Unoccupied Period ? N  ==================================	Saturday		
Cooling Available During Unoccupied Period ? N  ==================================	Sunday		X   X   X   X   X   X   X   X
MONTHLY SCHEDULES   JAN   FEB   MAR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC    Space/Skin Heating   XXX   XXX   XXX               XXX   XX		==========	
MONTHLY SCHEDULES   JAN   FEB   MAR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC    Space/Skin Heating   XXX   XXX   XXX               XXX   XX	Cooling Available During Unoccup	ied Period ?	N
Space/Skin Heating           XXX   X	=======================================	==========	
Central Heating   XXX   X	MONTHLY SCHEDULES   JAN   FEB	MAR   APR   MAY	JUN   JUL   AUG   SEP   OCT   NOV   DEC
Central Heating   XXX   X			
Central Heating   XXX	Space/Skin Heating   XXX   XXX	XXX	
Central Cooling			xxx   xxx   xxx   xxx
	Central Cooling	XXX   XXX   XXX	XXX   XXX   XXX   XXX

Type: CONSTANT VOLUME - Single Zone CAV	Name: AHU-6 PLC	12-30-94
Prepared by: EINHORN YAFFEE PRESCOTT	Type: CONSTANT VOLUME - Single Zon	e CAV HAP v3.04
1. SYSTEM NAME AND TYPE  Name	<del></del>	
Name	********	**********
Name		
Name	1. SYSTEM NAME AND TYPE	
Type		
Number of Zones.: 1	Name AHU-6 PLC	
2. SYSTEM DESCRIPTION  COOLING SYSTEM DATA Is Central Cooling Used ? N  HEATING SYSTEM DATA Supply Air Temperature ? 110.0 F  Fan Cycled for Heating. ? N  Supply Air Reset Not Used  OUTDOOR VENTILATION DATA Type of Control	Type CONSTANT VOLUM	E - Single Zone CAV
2. SYSTEM DESCRIPTION  COOLING SYSTEM DATA IS Central Cooling Used? N HEATING SYSTEM DATA Supply Air Temperature? 110.0 F Fan Cycled for Heating? Not Used  OUTDOOR VENTILATION DATA Type of Control	Number of Zones.: 1	
COOLING SYSTEM DATA  Is Central Cooling Used? N  HEATING SYSTEM DATA Supply Air Temperature? 110.0 F  Fan Cycled for Heating? N  Supply Air Reset Not Used  OUTDOOR VENTILATION DATA  Type of Control		
COOLING SYSTEM DATA  Is Central Cooling Used? N  HEATING SYSTEM DATA Supply Air Temperature? 110.0 F  Fan Cycled for Heating? N  Supply Air Reset Not Used  OUTDOOR VENTILATION DATA  Type of Control		
COOLING SYSTEM DATA IS Central Cooling Used. ? N  HEATING SYSTEM DATA  Supply Air Temperature. ? 110.0 F  Fan Cycled for Heating. ? N  Supply Air Reset Not Used  OUTDOOR VENTILATION DATA  Type of Control Constant Airflow Rate  Design Ventilation Airflow. : 100 %  Dampers Open During Unocc Per: N  Damper Leak Rate 2 %  SUPPLY DUCT DATA  Duct Heat Gain 2 %  RETURN PLENUM DATA Is a Return Plenum Used. ? N  SUPPLY FAN DATA Fan Type Forward Curved  Configuration Draw-Thru  Fan Total Static : 1.00 in.wg.  Fan Efficiency 54 %  RETURN FAN DATA Fan Type None  OUTDOOR AIR ECONOMIZER  OUTDOOR AIR ECONOMIZER  OUTDOOR AIR ECONOMIZER  OUTDOOR AIR ECONOMIZER  OUTDOOR COIL Precool Coil Used ? N  PRECOOL COIL  Precool Coil Used ? N  HUMIDIFICATION  Humidification System Used. ? N  VENTILATION HEAT RECLAIM Reclaim Unit Type None  SAFETY FACTORS  Sensible Cooling Factor . 0 %  Latent Cooling Factor . 0 %  Heating Factor . 0 %  Heating Factor . 0 %		
Is Central Cooling Used.		
### HEATING SYSTEM DATA  Supply Air Temperature		
Supply Air Temperature       ? Fan Cycled for Heating       N         Supply Air Reset       Not Used         OUTDOOR VENTILATION DATA       Not Used         Type of Control       Constant Airflow Rate         Design Ventilation Airflow       100 %         Dampers Open During Unocc Per:       N         Damper Leak Rate       2 %         SUPPLY DUCT DATA       2 %         Duct Heat Gain       2 %         Duct Leakage Rate       5 %         RETURN PLENUM DATA       N         Is a Return Plenum Used       N         SUPPLY FAN DATA       Forward Curved         Configuration       Draw-Thru         Fan Type       Forward Curved         Configuration       Draw-Thru         Fan Efficiency       54 %         RETURN FAN DATA       None         Fan Type       None         OUTDOOR AIR ECONOMIZER       None         Outdoor Economizer Type       None         PRECOCL COIL       Preheat Coil Used       N         Precocl Coil Used       N         HUMIDIFICATION       N         Humidification System Used       N         VENTILATION HEAT RECLAIM       None         SAFETY FACTORS	5	N
Fan Cycled for Heating		
Supply Air Reset       Not Used         OUTDOOR VENTILATION DATA       Constant Airflow Rate         Type of Control       100 %         Design Ventilation Airflow       100 %         Dampers Open During Unocc Per       N         Damper Leak Rate       2 %         SUPPLY DUCT DATA       2 %         Duct Heat Gain       2 %         Duct Leakage Rate       5 %         RETURN PLENUM DATA       N         Is a Return Plenum Used       N         SUPPLY FAN DATA       Forward Curved         Configuration       Draw-Thru         Fan Type       54 %         RETURN FAN DATA       None         Fan Efficiency       54 %         RETURN FAN DATA       None         OUTDOOR AIR ECONOMIZER       None         Outdoor Economizer Type       None         PREHEAT COIL       None         PRECOOL COIL       Precool Coil Used       ?         PRECOOL COIL       None         Precool Coil Used       ?       N         VENTILATION HEAT RECLAIM       None         SAFETY FACTORS       None         Sensible Cooling Factor       0 %         Latent Cooling Factor       0 %		
OUTDOOR VENTILATION DATA Type of Control		<del>-</del>
Type of Control		Not Used
Design Ventilation Airflow: 100 % Dampers Open During Unocc Per: N Damper Leak Rate: 2 % SUPPLY DUCT DATA Duct Heat Gain: 2 % Duct Leakage Rate: 5 % RETURN PLENUM DATA Is a Return Plenum Used? N SUPPLY FAN DATA Fan Type		
Dampers Open During Unocc Per:		
Damper Leak Rate		
SUPPLY DUCT DATA         Duct Leakage Rate       2 %         Duct Leakage Rate       5 %         RETURN PLENUM DATA       1 N         Is a Return Plenum Used       N         SUPPLY FAN DATA       Forward Curved         Fan Type       Forward Curved         Configuration       Draw-Thru         Fan Total Static       1.00 in.wg         Fan Efficiency       54 %         RETURN FAN DATA       None         OUTDOOR AIR ECONOMIZER       None         Outdoor Economizer Type       None         PREHEAT COIL       Preheat Coil Used       N         PRECOOL COIL       PRECOOL COIL         Precool Coil Used       ?       N         HUMIDIFICATION       N         Humidification System Used       ?       N         VENTILATION HEAT RECLAIM       None         SAFETY FACTORS       None         Sensible Cooling Factor       0 %         Latent Cooling Factor       0 %         Latent Cooling Factor       0 %         Heating Factor       0 %		
Duct Heat Gain	<del>-</del>	2 %
Duct Leakage Rate		
RETURN PLENUM DATA Is a Return Plenum Used. ? N SUPPLY FAN DATA Fan Type		
Is a Return Plenum Used. ? N  SUPPLY FAN DATA Fan Type Forward Curved Configuration Draw-Thru Fan Total Static 1.00 in.wg. Fan Efficiency 54 %  RETURN FAN DATA Fan Type None OUTDOOR AIR ECONOMIZER Outdoor Economizer Type None PREHEAT COIL Preheat Coil Used ? N  PRECOOL COIL Precool Coil Used ? N  HUMIDIFICATION Humidification System Used . ? N  VENTILATION HEAT RECLAIM Reclaim Unit Type None SAFETY FACTORS Sensible Cooling Factor 0 % Latent Cooling Factor 0 % Heating Factor 0 %		5 %
SUPPLY FAN DATA Fan Type		
Fan Type		N
Configuration: Draw-Thru Fan Total Static: 1.00 in.wg. Fan Efficiency: 54 %  RETURN FAN DATA Fan Type: None  OUTDOOR AIR ECONOMIZER  Outdoor Economizer Type: None  PREHEAT COIL Preheat Coil Used? N PRECOOL COIL Precool Coil Used? N HUMIDIFICATION Humidification System Used? N VENTILATION HEAT RECLAIM Reclaim Unit Type: None  SAFETY FACTORS Sensible Cooling Factor: 0 % Latent Cooling Factor: 0 % Heating Factor: 0 %		Toward Guard
Fan Total Static		
Fan Efficiency: 54 %  RETURN FAN DATA  Fan Type: None  OUTDOOR AIR ECONOMIZER  Outdoor Economizer Type: None  PREHEAT COIL  Preheat Coil Used? N  PRECOOL COIL  Precool Coil Used? N  HUMIDIFICATION  Humidification System Used? N  VENTILATION HEAT RECLAIM  Reclaim Unit Type: None  SAFETY FACTORS  Sensible Cooling Factor: 0 %  Latent Cooling Factor: 0 %  Heating Factor: 0 %		
RETURN FAN DATA  Fan Type: None  OUTDOOR AIR ECONOMIZER  Outdoor Economizer Type: None  PREHEAT COIL  Preheat Coil Used? N  PRECOOL COIL  Precool Coil Used? N  HUMIDIFICATION  Humidification System Used? N  VENTILATION HEAT RECLAIM  Reclaim Unit Type: None  SAFETY FACTORS  Sensible Cooling Factor: O %  Latent Cooling Factor: O %  Heating Factor: O %		
Fan Type: None  OUTDOOR AIR ECONOMIZER  Outdoor Economizer Type: None  PREHEAT COIL  Preheat Coil Used? N  PRECOOL COIL  Precool Coil Used? N  HUMIDIFICATION  Humidification System Used? N  VENTILATION HEAT RECLAIM  Reclaim Unit Type: None  SAFETY FACTORS  Sensible Cooling Factor: 0 %  Latent Cooling Factor: 0 %  Heating Factor: 0 %	-	54 6
OUTDOOR AIR ECONOMIZER Outdoor Economizer Type: None PREHEAT COIL Preheat Coil Used? N PRECOOL COIL Precool Coil Used? N HUMIDIFICATION Humidification System Used? N VENTILATION HEAT RECLAIM Reclaim Unit Type: None SAFETY FACTORS Sensible Cooling Factor: 0 % Latent Cooling Factor: 0 % Heating Factor: 0 %		None
Outdoor Economizer Type: None  PREHEAT COIL  Preheat Coil Used? N  PRECOOL COIL  Precool Coil Used? N  HUMIDIFICATION  Humidification System Used? N  VENTILATION HEAT RECLAIM  Reclaim Unit Type: None  SAFETY FACTORS  Sensible Cooling Factor: 0 %  Latent Cooling Factor: 0 %  Heating Factor: 0 %		None
PREHEAT COIL Preheat Coil Used? N  PRECOOL COIL Precool Coil Used? N  HUMIDIFICATION Humidification System Used? N  VENTILATION HEAT RECLAIM Reclaim Unit Type: None  SAFETY FACTORS Sensible Cooling Factor: 0 % Latent Cooling Factor: 0 % Heating Factor: 0 %		None
Preheat Coil Used? N  PRECOOL COIL Precool Coil Used? N  HUMIDIFICATION Humidification System Used? N  VENTILATION HEAT RECLAIM Reclaim Unit Type: None  SAFETY FACTORS Sensible Cooling Factor: 0 % Latent Cooling Factor: 0 % Heating Factor: 0 %		None
PRECOOL COIL Precool Coil Used? N HUMIDIFICATION Humidification System Used? N VENTILATION HEAT RECLAIM Reclaim Unit Type: None SAFETY FACTORS Sensible Cooling Factor: 0 % Latent Cooling Factor: 0 % Heating Factor: 0 %		N
Precool Coil Used? N HUMIDIFICATION Humidification System Used? N VENTILATION HEAT RECLAIM Reclaim Unit Type: None SAFETY FACTORS Sensible Cooling Factor: 0 % Latent Cooling Factor: 0 % Heating Factor: 0 %		14
HUMIDIFICATION Humidification System Used?  VENTILATION HEAT RECLAIM Reclaim Unit Type:  SAFETY FACTORS Sensible Cooling Factor: Latent Cooling Factor: Heating Factor:  0 %		N
Humidification System Used? N  VENTILATION HEAT RECLAIM  Reclaim Unit Type: None  SAFETY FACTORS  Sensible Cooling Factor: 0 %  Latent Cooling Factor: 0 %  Heating Factor: 0 %		14
VENTILATION HEAT RECLAIM Reclaim Unit Type: None SAFETY FACTORS Sensible Cooling Factor: 0 % Latent Cooling Factor: 0 % Heating Factor: 0 %		N
Reclaim Unit Type: None  SAFETY FACTORS  Sensible Cooling Factor: 0 %  Latent Cooling Factor: 0 %  Heating Factor: 0 %	<del>-</del>	
SAFETY FACTORS  Sensible Cooling Factor: 0 %  Latent Cooling Factor: 0 %  Heating Factor: 0 %		None
Sensible Cooling Factor: 0 % Latent Cooling Factor: 0 % Heating Factor: 0 %	——————————————————————————————————————	10110
Latent Cooling Factor: 0 % Heating Factor: 0 %		0 %
Heating Factor 0 %	<del>-</del>	
	_	

Name: AHU-6 PLC Type: CONSTANT VOLUME - S Prepared by: EINHORN YAFF ***********************************	FEE I	PRES	COTT		***:	****	***	***	***	****	HAP Pa		
3. ZONE DATA													
ZONE					1	 (All	Zor	· ies	 the	Same	 e)		
T-Stat Occupied Cooling	(E	7):		7	5.0						•		
Unoccupied Cooling	j(I	F):		8	5.0								
Occupied Heating	(E	?) :		7	0.0								
Unoccupied Heating	j(1	?):		5!	5.0								
Throttling Range	(1	?):		:	3.0								
Zone Heating Unit Type		:	i	Skin	BB								
Trip Temperature	(E	₹):		3.	5.0								
Design Supply Temperatu	ıre(E	7):			-								
Fan Total Static(ir					-								
Fan Efficiency					-								
Zone Terminal Type			D	iffu	ser								
Reheat Coil					N								
Direct Exhaust Airflow				540	0.0								
Direct Exhaust Fan kW	. (kv	4) :		:	L.4								
=======================================	====			====	====:		====		===	====	====	====	
A COMPANIE DAMA													
4. SCHEDULE DATA							====	===					
HOURLY TSTAT SCHEDULES	010	010	00	010	010	1111	1 1	1   1	11	1   1   1	1212	2 2	
												2 3	
Design Day		1		X	$ \mathbf{x} \mathbf{x}$	$ \mathbf{x} \mathbf{x} $	$\mathbf{x} \mid \mathbf{x}$	$ \mathbf{x} \mathbf{x}$	X	$x \mid x \mid x$	$x \mid x \mid x$	X	
Weekday			ĺ	X	$ \mathbf{x} \mathbf{x}$	$ \mathbf{x} \mathbf{x}$	$\mathbf{x} \mid \mathbf{x}$	$ \mathbf{x} \mathbf{x}$	x	x   x   x	$\mathbf{x}   \mathbf{x}   \mathbf{x}$	x	
Saturday							$X \mid X$	$ \mathbf{x} \mathbf{x}$	X	$x \mid x \mid x$	$\mathbf{x} \mid \mathbf{x} \mid \mathbf{z}$	X	
Sunday						X X	$x \mid x$	$ \mathbf{x} \mathbf{x}$	X	$x \mid x \mid$			
MONTHLY SCHEDULES			====  MAR	====:   APR	====:   May	   אודה	===: .TTT.	==== LAUG	===	==== p oc1	==== VOV	DEC	
					. <b></b>								
Space/Skin Heating	XXX	xxx	xxx	l	l				1	XXX	xxx	xxx	
Central Heating			•	•	ĺ				xx			XXX	
	- 1				•			'	1	'	1	1	

Name: AHU-1 DDC  Type: CONSTANT VOLUME - Single Zone Prepared by: EINHORN YAFFEE PRESCOT ************************************	'T	12-30-94 HAP v3.04 Page 1
1. SYSTEM NAME AND TYPE		
Name: AHU-1 DDC Type: CONSTANT VOLUME Number of Zones.: 1	: - Single Zo	one CAV
2. SYSTEM DESCRIPTION		
COOLING SYSTEM DATA		
Is Central Cooling Used?	Y	
Supply Air:	55.0	F
Coil Bypass Factor:	0.100	
Fan Cycled for Cooling?	N	
	Not Used	
Is Central Heating Used?	Y	
Fan Cycled for Heating?	N	
Supply Air Reset:	Not Used	
OUTDOOR VENTILATION DATA		
Type of Control:	Constant Ai	rflow Rate
Design Ventilation Airflow:	2135.0	
Dampers Open During Unocc Per.:	N	· · ·
Damper Leak Rate:	2	2
SUPPLY DUCT DATA	2	•
Duct Heat Gain:	2	9.
	5	
Duct Leakage Rate:	5	6
RETURN PLENUM DATA	37	
Is a Return Plenum Used?	N	
SUPPLY FAN DATA	_ , , , _	
Fan Type:		nclined or Airfoil
Configuration:	Draw-Thru	
Fan Total Static:	2.00	in.wg.
Fan Efficiency:	54	8
RETURN FAN DATA		
Fan Type:	Backward Ir	nclined or Airfoil
Fan Total Static:	0.25	in.wg.
Fan Efficiency:	54	%
OUTDOOR AIR ECONOMIZER		
Outdoor Economizer Type:	Integrated	Enthalpy
OA Upper Cutoff Temp:	95.0	F
OA Lower Cutoff Temp:	0.0	F
PREHEAT COIL		
Preheat Coil Used?	N	
PRECOOL COIL		
Precool Coil Used?	N	
HUMIDIFICATION		
Humidification System Used?	N	
DEHUMIDIFICATION	21	
Dehumidification System Used?	N	
VENTILATION HEAT RECLAIM	N	
	None	
Reclaim Unit Type:		

Name: AHU-1 DDC Type: CONSTANT VOLUME - Single Zone ( Prepared by: EINHORN YAFFEE PRESCOTT ***********************************	12-30-94 CAV HAP v3.04 Page 2 ************************************
2. SYSTEM DESCRIPTION (CONTINUED)	
SAFETY FACTORS Sensible Cooling Factor: Latent Cooling Factor: Heating Factor:	0 % 0 % 0 %
3. ZONE DATA	
Trip Temperature(F): Design Supply Temperature(F): Fan Total Static(in.wg.): Fan Efficiency(%):	1 (All Zones the Same) 75.0 85.0 70.0 55.0 3.0 Skin BB 35.0 iffuser N 0.0 0.0
4. SCHEDULE DATA	
HOURLY TSTAT SCHEDULES  0 0 0 0 0	0 0 0 0 1 1 1 1 1 1 1 1 1 1 2 2 2 2  6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3
Design Day	
Cooling Available During Unoccupied	Period ? N
	APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC
Space/Skin Heating   XXX   XXX   XXX   Central Heating   XXX   XXX	

Name: AHU-2 DDC	12-30-94
Type: CONSTANT VOLUME - Multizone	HAP v3.04
Prepared by: EINHORN YAFFEE PRESCO	
**********	**************
1. SYSTEM NAME AND TYPE	
Name AHU-2 DDC	
Type CONSTANT VOLUM	E - Multizone
Number of Zones.: 3	
=======================================	
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	·
Cold Deck Temperature:	55.0 F
Coil Bypass Factor:	0.100
Cold Deck Reset:	Greatest Demand
Maximum Reset Temperature:	60.0 F
HEATING SYSTEM DATA	
Hot Deck Temperature:	110.0 F
Hot Deck Reset:	Greatest Demand
Minimum Reset Temperature:	90.0 F
OUTDOOR VENTILATION DATA	
2 E -	Constant Airflow Rate
Design Ventilation Airflow:	4300.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate:	2 %
SUPPLY DUCT DATA  Duct Heat Gain:	2 %
Duct Leakage Rate:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used?	N
SUPPLY FAN DATA	
Fan Type:	Forward Curved
Fan Total Static:	2.00 in.wg.
Fan Efficiency:	54 %
RETURN FAN DATA	
Fan Type:	
Fan Total Static:	0.25 in.wg.
Fan Efficiency OUTDOOR AIR ECONOMIZER	54 %
Outdoor Economizer Type:	Integrated Enthalpy
OA Upper Cutoff Temp:	95.0 F
OA Lower Cutoff Temp:	0.0 F
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type:	None
SAFETY FACTORS	0. 9
Sensible Cooling Factor:	0 % 0 %
Latent Cooling Factor  Heating Factor	0 %
	· · · · · · · · · · · · · · · · · · ·

Name: AHU-2 DDC Type: CONSTANT VOLUME - Mul Prepared by: EINHORN YAFFEE	PRESCOTT Page 2
3. ZONE DATA	****************
ZOM	1 (711 France black Court)
ZONE T-Stat Occupied Cooling	1 (All Zones the Same) (F): 75.0
Unoccupied Cooling	
Occupied Heating	
Unoccupied Heating	
Throttling Range	
Zone Heating Unit Type	
Trip Temperature	(F): -
Design Supply Temperature	
Fan Total Static(in.v	
Fan Efficiency	
Zone Terminal Type	
Reheat Coil	
Diversity Factor	
Direct Exhaust Airflow(C	
======================================	, ,
4. SCHEDULE DATA	
HOURLY TSTAT SCHEDULES 0	0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 2 2 2 2
	1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3
·	
Design Day	
Weekday	
Saturday	
Sunday	
Cooling Available During Ur	against David 2. N
_	occupied Period ? N
	n   feb   mar   apr   may   jun   jul   aug   sep   oct   nov   dec
Central Heating   XX	x xxx xxx
Central Cooling	
=======================================	

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Type: CONSTANT VOLUME - Single Zone	CRIT	
	CAV	HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOT	Γ	Page 1
*********	******	*********
1. SYSTEM NAME AND TYPE		
Name AHU-3 DDC		
Type CONSTANT VOLUME	- Single Zo	one CAV
Number of Zones.: 1		
=======================================	==========	=======================================
o avaman pragripaton		
2. SYSTEM DESCRIPTION		
COOLING SYSTEM DATA		
Is Central Cooling Used?	Y	
Supply Air	55.0	Ŧ
Coil Bypass Factor:	0.100	•
Fan Cycled for Cooling?	N	
Supply Air Reset:	Not Used	
HEATING SYSTEM DATA		
Is Central Heating Used?	Y	
Fan Cycled for Heating?	N	
Supply Air Reset:	Not Used	
OUTDOOR VENTILATION DATA		
Type of Control:	Constant Ai	irflow Rate
Design Ventilation Airflow:	720.0	CFM
Dampers Open During Unocc Per.:	N	
Damper Leak Rate:	2	ે
SUPPLY DUCT DATA		
Duct Heat Gain:	2	90
Duct Leakage Rate:	5	9
RETURN PLENUM DATA		
Is a Return Plenum Used?	N	
SUPPLY FAN DATA	_ ,	-1 -1 -1 -1
Fan Type:		nclined or Airfoil
	Draw-Thru	in
Fan Total Static:		in.wg.
Fan Efficiency RETURN FAN DATA	54	76
Fan Type:	Backward Ir	nclined or Airfoil
Fan Total Static:		in.wg.
Fan Efficiency:	54	
OUTDOOR AIR ECONOMIZER	0.1	•
Outdoor Economizer Type:	Integrated	Enthalpy
OA Upper Cutoff Temp:	95.0	
OA Lower Cutoff Temp:	0.0	F
PREHEAT COIL		
Preheat Coil Used?	N	
PRECOOL COIL		
Precool Coil Used?	N	
HUMIDIFICATION		
Humidification System Used?	N	
DEHUMIDIFICATION		
Dehumidification System Used?	N	
VENTILATION HEAT RECLAIM		
Reclaim Unit Type:	None	

Name: AHU-3 DDC  Type: CONSTANT VOLUME - Single Zone CAV  Prepared by: EINHORN YAFFEE PRESCOTT  **********************************	12-30-94 HAP v3.04 Page 2						
2. SYSTEM DESCRIPTION (CONTINUED)							
SAFETY FACTORS Sensible Cooling Factor: Latent Cooling Factor: Heating Factor:	0 % 0 % 0 %						
3. ZONE DATA							
ZONE 1 T-Stat Occupied Cooling(F): 75.0	(All Zones the Same)						
HOURLY TSTAT SCHEDULES  0 0 0 0 0 0 0 0	  1 1 1 1 1 1 1 1 1 2 2 2 2						
0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9 0 1 2 3						
Weekday	X   X   X   X   X   X   X   X   X   X						
Cooling Available During Unoccupied Period ? N							
MONTHLY SCHEDULES   JAN   FEB   MAR   APR   MAY	JUN JUL AUG SEP OCT NOV DEC						

Name: AHU-4 DDC		12-30-94
Type: CONSTANT VOLUME - Multizone		HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOT	T	Page 1
*********		<b>3</b>
1. SYSTEM NAME AND TYPE		
Name AHU-4 DDC		
Type : CONSTANT VOLUME	- Multizone	2
Number of Zones.: 7		
		=======================================
2. SYSTEM DESCRIPTION		
COOLING SYSTEM DATA		
Cold Deck Temperature:	55.0	F
Coil Bypass Factor:	0.100	
Cold Deck Reset:	Greatest De	emand
Maximum Reset Temperature:	60.0	F
HEATING SYSTEM DATA		
Hot Deck Temperature:	110.0	F
Hot Deck Reset:	Greatest De	emand
Minimum Reset Temperature:	90.0	F
OUTDOOR VENTILATION DATA		
	Constant A	irflow Rate
Design Ventilation Airflow:	2160.0	CFM
Dampers Open During Unocc Per.:	N	
Damper Leak Rate:	2	8
SUPPLY DUCT DATA	_	
Duct Heat Gain:		8
Duct Leakage Rate:	5	8
RETURN PLENUM DATA		
Is a Return Plenum Used?	N	
SUPPLY FAN DATA	Da G	3
Fan Type:		
Fan Total Static:		in.wg.
Fan Efficiency RETURN FAN DATA	54	6
Fan Type:	Backward Tr	nclined or Airfoil
Fan Total Static:		in.wq.
Fan Efficiency:	54	_
OUTDOOR AIR ECONOMIZER	34	0
Outdoor Economizer Type:	Integrated	Enthalpy
OA Upper Cutoff Temp	95.0	
OA Lower Cutoff Temp	0.0	
PREHEAT COIL		-
Preheat Coil Used?	N	
PRECOOL COIL		
Precool Coil Used?	N	
VENTILATION HEAT RECLAIM		
Reclaim Unit Type:	None	
SAFETY FACTORS		
Sensible Cooling Factor:	0	90
Latent Cooling Factor:	0	%
Heating Factor:		४
	:=======	

Name: AHU-4 DDC					12-30-94	
Type: CONSTANT VOLUME - Multiz					HAP v3.04	
Prepared by: EINHORN YAFFEE PR					Page 2	
********	*****	*****	*****	*****	******	
3. ZONE DATA						
ZONE		1	(All Zor	nes the	Same)	
T-Stat Occupied Cooling(F)	:	75.0	•		,	
Unoccupied Cooling(F)		85.0				
Occupied Heating(F)		70.0				
Unoccupied Heating(F)		55.0				
Throttling Range(F)		3.0				
Zone Heating Unit Type		None				
Trip Temperature(F)		_				
Design Supply Temperature(F)		-				
Fan Total Static(in.wg.)		_				
Fan Efficiency(%)		_				
Zone Terminal Type		V MBox				
Reheat Coil		N				
Diversity Factor(%)		100				
Direct Exhaust Airflow(CFM)		0.0				
Direct Exhaust Fan kW(kW)	:	0.0				
=======================================		======	=======	-=====	=========	
4. SCHEDULE DATA						
					========	
					1   1   1   2   2   2   2	
0 1 2	2   3   4   5	6 7 8 9	0 1 2 3	4 5 6 1	7 8 9 0 1 2 3	
Danier Dan		lvlvlv	lviviviv	lvivivi		
Design Day					X   X   X   X   X   X	
Weekday					X   X   X   X   X   X	
Saturday			: : : :	: : : :	X X X X X X X X X X X X X X X X X X X	
Sunday			X   X   X   X	^   ^   ^   ^	X   A	
Cooling Available During Unoccupied Period ? N						
					POCT NOV DEC	
Central Heating   XXX   X	XXX XXX	xxx		xxx	x   xxx   xxx   xxx	
Central Cooling			xxx xxx			
	·					

	EW INDOL DATA	
Name: AHU-5 DDC	o CNI	12-30-94
Type: CONSTANT VOLUME - Single Zon Prepared by: EINHORN YAFFEE PRESCO		HAP v3.04
*******************		Page 1 ***********
1. SYSTEM NAME AND TYPE		
Name AHU-5 DDC		
Type CONSTANT VOLUM	E - Single Zo	one CAV
Number of Zones.: 1		
	========	
2. SYSTEM DESCRIPTION		
COOLING SYSTEM DATA		
Is Central Cooling Used?	Y	
Supply Air	55.0	ਸ
Coil Bypass Factor	0.100	•
Fan Cycled for Cooling?	N N	
Supply Air Reset:	Not Used	
HEATING SYSTEM DATA		
Is Central Heating Used?	Y	
Fan Cycled for Heating?	N	
Supply Air Reset:	Not Used	
OUTDOOR VENTILATION DATA		
Type of Control:	Constant A:	irflow Rate
Design Ventilation Airflow:	960.0	CFM
Dampers Open During Unocc Per.:	N	
Damper Leak Rate:	2	8
SUPPLY DUCT DATA		
Duct Heat Gain:	2	<b>ે</b>
Duct Leakage Rate:	5	<b>ે</b>
RETURN PLENUM DATA		
Is a Return Plenum Used?	N	
SUPPLY FAN DATA		_
Fan Type:	Forward Cu	rved
Configuration:	Draw-Thru	
Fan Total Static:		in.wg.
Fan Efficiency:	54	8
RETURN FAN DATA	Doglersond Tr	nclined or Airfoil
Fan Type Fan Total Static		in.wg.
Fan Efficiency	54	_
OUTDOOR AIR ECONOMIZER	JŦ	0
Outdoor Economizer Type:	Integrated	Enthalpy
OA Upper Cutoff Temp	95.0	
OA Lower Cutoff Temp:	0.0	
PREHEAT COIL		
Preheat Coil Used?	N	
PRECOOL COIL		
Precool Coil Used?	N	
HUMIDIFICATION		
Humidification System Used?	N	
DEHUMIDIFICATION -		
Dehumidification System Used?	N	
VENTILATION HEAT RECLAIM		
Reclaim Unit Type:	None	

Name: AHU-5 DDC	12-30-94						
Type: CONSTANT VOLUME - Single Zone	CAV HAP v3.04						
Prepared by: EINHORN YAFFEE PRESCOTT	Page 2						
***********************							
2. SYSTEM DESCRIPTION (CONTINUED)							
SAFETY FACTORS							
Sensible Cooling Factor:	0 %						
Latent Cooling Factor:	0 %						
Heating Factor:	0 %						
=======================================							
3. ZONE DATA							
GOVE	1 (7) 7 the Game)						
ZONE T-Stat Occupied Cooling(F):	1 (All Zones the Same) 75.0						
Unoccupied Cooling(F):	85.0						
Occupied Heating(F):	70.0						
Unoccupied Heating(F):	55.0						
Throttling Range(F):	3.0						
<del>-</del>	Skin BB						
Trip Temperature(F):	35.0						
Design Supply Temperature(F):	-						
Fan Total Static(in.wg.):	-						
Fan Efficiency(%):							
Zone Terminal Type D Reheat Coil?	iffuser N						
Direct Exhaust Airflow(CFM):	0.0						
Direct Exhaust Fan kW(kW):	0.0						
4. SCHEDULE DATA							
	0000011111111111111112222						
	6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3						
Design Day	x x x x x x x x x x x x x x x x						
Weekday							
Saturday							
Sunday							
Cooling Available During Unoccupied Period ? N							
	APR MAY JUN JUL AUG SEP OCT NOV DEC						
Space/Skin Heating   XXX   XXX   XXX							
Central Heating   XXX   XXX   XXX							
	XXX XXX XXX XXX XXX						
=======================================							

Name: AHU-6 DDC	12-30-94
Type: CONSTANT VOLUME - Single Zone	e CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCO	
	- **************
1. SYSTEM NAME AND TYPE	
	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Name AHU-6 DDC	
Type CONSTANT VOLUM	E - Single Zone CAV
Number of Zones.: 1	
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Is Central Cooling Used?	N
HEATING SYSTEM DATA	
Supply Air Temperature?	110.0 F
Fan Cycled for Heating?	N
Supply Air Reset:	Not Used
OUTDOOR VENTILATION DATA	
	Constant Airflow Rate
Design Ventilation Airflow:	100 %
Dampers Open During Unocc Per.:	N
Damper Leak Rate:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain:	2 %
Duct Leakage Rate:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used?	N
SUPPLY FAN DATA	
Fan Type:	Forward Curved
Configuration:	Draw-Thru
Fan Total Static:	1.00 in.wg.
Fan Efficiency:	54 %
RETURN FAN DATA	
Fan Type:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	None
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used?	N
HUMIDIFICATION	
Humidification System Used?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type:	None
SAFETY FACTORS	
Sensible Cooling Factor:	0 %
Latent Cooling Factor:	0 %
Heating Factor:	0 %
=======================================	

Name: AHU-6 DDC																		12	- 3	0 -	94
Type: CONSTANT VOLUME - Single Zone CAV								HAP v3.04													
Prepared by: EINHORN YAFFEE PRESCOTT										Р	ag	e	2								
******	***	**	* * *	* * *	***	**	**	***	**	* * *	* * *	**	* *	**	* *	**	* *	**	**	**	**
3. ZONE DATA																					
ZONE							1	(	Al:	L 2	zor.	ıes	t	he	S	am	e)				
T-Stat Occupied Cooling							.0														
Unoccupied Cooling.							.0														
Occupied Heating							.0														
Unoccupied Heating.						55	. 0														
Throttling Range							.0														
Zone Heating Unit Type				ξ	Ski	.n	BB														
Trip Temperature						35	. 0														
Design Supply Temperature							-														
Fan Total Static(in.							-														
Fan Efficiency	. (원	s):					-														
Zone Terminal Type		.:		Di	iff	us	er														
Reheat Coil		.?					N														
Direct Exhaust Airflow(	CFM	1):			54	00	0.0														
Direct Exhaust Fan kW	(kV	I) :				1	. 4														
=======================================	===	===	===	===	===	==	===	===	==:	===	===	==	==	==	==	==	==	==	==	==	==
4. SCHEDULE DATA																					
=======================================	===	==	===	===	===	==	===		==	===	===	===	==	==	==	==	==	==	==	==	==
			0   0																		
0	11	2	3   4	5	6	7	8   9	9   0	1	2	3	4	5	6	7	8	9	0	1	2	3
						<b>-</b> -															
Design Day						$\mathbf{x}$	$X \mid X$	$X \mid X$	:   X	X	Х	Х	х	$X \mid$	$x \mid$	х	х	$X \mid$	X	X	
Weekday						х	$X \mid X$	$X \mid X$	:   X	X	X	$X \mid$	X	X	x	$X \mid$	х	x	X	X	
Saturday										X	X	X	X	х	x	X	х	X	Χļ	X	
Sunday			1			-		X	:   X	X	X	х	х	$x \mid$	х	х					
=======================================	===	===	===	===	===	===	==:	===	==:	===	===	===	==	==	==	==	==	==	==	==	==
MONTHLY SCHEDULES J	AN	FE	в М	AR	AF	PR	MA	Y   J	UN	JΠ	JL	AU	IG	SE	P	OC	T	NO	V	DE	C
			 			 I				 I	 I		 I		 I		 	7777	 		 v-l
Space/Skin Heating X						,,,		-						3232	- :					XX	
Central Heating X	AX	XX	^ X	AA 	A.X			 <b></b> -		 <b></b> -	ا - <b>-</b> -	- 	 	XX	^   		.A	XX	.A		^   

Name: AHU-1 Baseline			12-30-94
Type: CONSTANT VOLUME - Sin	gle Zone CA	V	HAP v3.04
Prepared by: EINHORN YAFFEE	PRESCOTT		Page 1
*******	*****	******	******
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
=======================================	========	=======================================	==========
SPACES IN ZONE 1 (Zone 1)			
2. AHU-1 Assembly / Tra	vel 1		

Name: AHU-2 Baseline Type: CONSTANT VOLUME - Mult Prepared by: EINHORN YAFFEE	PRESCOTT		12-30-94 HAP v3.04 Page 1
**************************************			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
3. AHU 2-1 Multi-Purpose			
SPACES IN ZONE 2 (Zone 2)			
4. AHU 2-2 Stage	1		==========
SPACES IN ZONE 3 (Zone 3)			
5. AHU 2-3 Multi-Purpose	1 ======		

Name: AHU-3 Baseline			12-30-94
Type: CONSTANT VOLUME - Sing	le Zone CA	ĄV	HAP v3.04
Prepared by: EINHORN YAFFEE	PRESCOTT		Page 1
********	*****	**********	*****
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
=======================================	========		=========
SPACES IN ZONE 1 (Zone 1)			
6. AHU 3 Concourse	1		

Name: AHU-4 Baseline Type: CONSTANT VOLUME - Mult Prepared by: EINHORN YAFFEE **********************************	PRESCOTT	*******	12-30-94 HAP v3.04 Page 1
1. SPACE SELECTION			
Space Name		Space Name	
SPACES IN ZONE 1 (Zone 1)			
	1		
SPACES IN ZONE 2 (Zone 2)			
	1		
SPACES IN ZONE 3 (Zone 3)			========
9. AHU 4-3 Mini Auditoriu	ım 1		
SPACES IN ZONE 4 (Zone 4)	=======		=======================================
10. AHU 4-4 Crafts Room			
SPACES IN ZONE 5 (Zone 5)			=============
11. AHU 4-5 Reading Room	1		
SPACES IN ZONE 6 (Zone 6)	*======	=======================================	========
12. AHU 4-6 Office			
SPACES IN ZONE 7 (Zone 7)			=======================================
13. AHU 4-7 Offices	1		=======================================

Name: AHU-5 Baseline			12-30-94
Type: CONSTANT VOLUME - Sing	rle Zone C	V	HAP v3.04
Prepared by: EINHORN YAFFEE	PRESCOTT		Page 1
********	*****	******	******
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)	=======	=======================================	=======================================
14. AHU 5 Acivity Room	1		

Name: AHU-6 Baseline Type: CONSTANT VOLUME - Singl			12-30-94 HAP v3.04
Prepared by: EINHORN YAFFEE I			Page 1
****			*****
1. SPACE SELECTION			
Space Name	Otv	Space Name	Oty
Space Name	Qty	Space Name	Qty
•		Space Name	Qty

Name: AHU-1 PLC			12-30-94
Type: CONSTANT VOLUME - Sing	le Zone C	AV	HAP v3.04
Prepared by: EINHORN YAFFEE	PRESCOTT		Page 1
********	*****	******	******
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
	========	=======================================	~~ <i>I</i>
SPACES IN ZONE 1 (Zone 1)			
2. AHU-1 Assembly / Trav			

Name: AHU-2 PLC			12-30-94
Type: CONSTANT VOLUME - Mult	izone		HAP v3.04
Prepared by: EINHORN YAFFEE	PRESCOTT		Page 1
*********	******	*******	*********
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
=======================================	=======	=======================================	=========
SPACES IN ZONE 1 (Zone 1)			
3. AHU 2-1 Multi-Purpose	1		
=======================================			==============
SPACES IN ZONE 2 (Zone 2)			
4. AHU 2-2 Stage	1		
	=======		=======================================
SPACES IN ZONE 3 (Zone 3)			
5. AHU 2-3 Multi-Purpose	1		

Name: AHU-3 PLC			12-30-94
Type: CONSTANT VOLUME - Sing	le Zone C	AV	HAP v3.04
Prepared by: EINHORN YAFFEE	PRESCOTT		Page 1
*******	*****	******	*****
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
6. AHU 3 Concourse	<b></b>		

Name: AHU-4 PLC Type: CONSTANT VOLUME - Mu Prepared by: EINHORN YAFFE ***********************************	E PRESCOTT		12-30-94 HAP v3.04 Page 1
1. SPACE SELECTION	******	*********	******
1. SPACE SELECTION			
Space Name	<del>-</del>	-	Qty
SPACES IN ZONE 1 (Zone 1)			
	1		
SPACES IN ZONE 2 (Zone 2)			
8. AHU 4-2 TV Room	1		
SPACES IN ZONE 3 (Zone 3)			
9. AHU 4-3 Mini Auditor		·	
SPACES IN ZONE 4 (Zone 4)			
10. AHU 4-4 Crafts Room	1		
SPACES IN ZONE 5 (Zone 5)			
11. AHU 4-5 Reading Room	1	·	
SPACES IN ZONE 6 (Zone 6)			
12. AHU 4-6 Office	1	·	
SPACES IN ZONE 7 (Zone 7)	========	.======================================	=======================================
	1		

Name: AHU-5 PLC			12-30-94
Type: CONSTANT VOLUME - Singl	.e Zone CAV		HAP v3.04
Prepared by: EINHORN YAFFEE F	RESCOTT		Page 1
*******	*****	*******	*****
1. SPACE SELECTION			
	. <del></del>		
Space Name	Qty	Space Name	Qty
_		- :====================================	========
SPACES IN ZONE 1 (Zone 1)			
14. AHU 5 Acivity Room	1		

Name: AHU-6 PLC			12-30-94
Type: CONSTANT VOLUME - Single	e Zone CAV		HAP v3.04
Prepared by: EINHORN YAFFEE P	RESCOTT		Page 1
*******	*****	*******	*****
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
15. AHU 6 Travel / Kitchen	1		

Name: AHU-1 DDC			12-30-94
Type: CONSTANT VOLUME - Sing	gle Zone C <i>l</i>	$\Lambda \Lambda$	HAP v3.04
Prepared by: EINHORN YAFFEE	PRESCOTT		Page 1
********	******	******	*****
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			_
2. AHU-1 Assembly / Tra	vel 1		

Name: AHU-2 DDC			12-30-94
Type: CONSTANT VOLUME - Mult	izone		HAP v3.04
Prepared by: EINHORN YAFFEE	PRESCOTI	[	Page 1
*******	*****	*******	*****
1. SPACE SELECTION			
Grand Name			
	_	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
3. AHU 2-1 Multi-Purpose			
SPACES IN ZONE 2 (Zone 2)			
4. AHU 2-2 Stage	1		
SPACES IN ZONE 3 (Zone 3)			
	1		

Name: AHU-3 DDC Type: CONSTANT VOLUME - Sing Prepared by: EINHORN YAFFEE **********************************	PRESCOTT		12-30-94 HAP v3.04 Page 1
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)	=======		
6. AHU 3 Concourse	1		=======================================

Name: AHU-4 DDC Type: CONSTANT VOLUME - Mult	izone		12-30-94 HAP v3.04
Prepared by: EINHORN YAFFEE			Page 1
*************		*******	******
1. SPACE SELECTION			
Space Name			Qty
SPACES IN ZONE 1 (Zone 1)			
7. AHU 4-1 Music Room	1		
SPACES IN ZONE 2 (Zone 2)			
8. AHU 4-2 TV Room	1		
SPACES IN ZONE 3 (Zone 3)			
9. AHU 4-3 Mini Auditoriu	ım 1		
SPACES IN ZONE 4 (Zone 4)			
10. AHU 4-4 Crafts Room	1		
SPACES IN ZONE 5 (Zone 5)			
11. AHU 4-5 Reading Room	1		
SPACES IN ZONE 6 (Zone 6)			
12. AHU 4-6 Office	1	=======================================	
SPACES IN ZONE 7 (Zone 7)			
13. AHU 4-7 Offices	1	=======================================	=======================================

Name: AHU-5 DDC			12-30-94
Type: CONSTANT VOLUME - Sing	le Zone	CAV	HAP v3.04
Prepared by: EINHORN YAFFEE	PRESCOTT		Page 1
*******	*****	*******	*****
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)		=======================================	=======================================
14. AHU 5 Acivity Room	1		

			12-30-94
Type: CONSTANT VOLUME - Singl	le Zone CAV		HAP v3.04
Prepared by: EINHORN YAFFEE E	PRESCOTT		Page 1
*********	*****	*******	******
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
-		Space Name	

Plant: Cooling Plant Prepared By: EINHORN N	AFFEE PRE	ESCOTT	****	*****	*****	12-30-94 Page 1
PLANT NAME, CLASSIFICA	ATION & TY	PE				
Plant name Classification Type Type of simulation r Type of chiller		Cooling Air-Cool Computer A/C Rec	led Chi r-Gener	ller ated	ine	
AIR SYSTEM SELECTIONS						
Air System Name		· <b></b>	Туре	Q۱	uantity	
1. AHU-1 Baseline 2. AHU-2 Baseline 3. AHU-3 Baseline 4. AHU-4 Baseline 5. AHU-5 Baseline	e		. (MZ) . (SZ . (MZ)	CAV)	1 1 1 1	
Estimated maximum concluder capacity at Chiller input power Chiller configuration is chilled water results hot gas bypass us load for minimum Crankcase heater kW	design at designon set used sed unloading.	: 1: Mul?	NA 112.0 1.200 lt. Com N N 20.0	kW/Ton pressor: %	s / Ckt.,	Unloaded
PUMP AND PIPING SYSTEM	ATAG N					
Pump or Piping System	Delta-T (F)		Mech	encies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Chilled Water	10.0	54.00	80.0	89.0	3.84	5.0

Plant: Heating Plant - Prepared By: EINHORN YF *********	AFFEE PRES		*****	*****	*****	12-30-94 Page 1
PLANT NAME, CLASSIFICAT	TION & TYP	E				
Plant name		Heating Hot Wat	er Boil	- Baseli	ne	
AIR SYSTEM SELECTIONS						
Air System Name		Pr	Hea e-Heat	ting Coi Central	l Category Terminal	,
1. AHU-1 Baseline				1	-	1
2. AHU-2 Baseline			-	1	-	-
3. AHU-3 Baseline				1	-	1
4. AHU-4 Baseline				1	=	-
5. AHU-5 Baseline			-	1	-	1
6. AHU-6 Baseline				1		1 
HOT WATER BOILER DATA						1
HOI WAIER BOILLER DAIA	<b></b> .					
Estimated maximum head Gross output at design Energy input at design Overall efficiency at Fuel or energy type. Combustion air blower	gn gn design	: : : Na	1339.0 1575.0 85.0	MBH MBH %		
BOILER PART-LOAD PERI	FORMANCE I	ATA				
% Load Overall Eff.	(%) %	Load O	verall	Eff. (%)		
90 85.0		40	85	5.0		
80 85.0		30	85	5.0		
70 85.0		20	85	5.0		,
60 85.0		10		5.0		1000
50 85.0		0		).0 . <del>.</del>		
PUMP AND PIPING SYSTEM						
						Piping
Pump or	Delta-T	Head	Mech	Elec	Power	Gain/Loss
Piping System	(F)					(%)

it should be included as a first load souther.

C-80 in the input. Where should be hard.

Plant: Cooling Plant - Prepared By: EINHORN YA ************************************	AFFEE PRESCOTT ************	******	*******	12-30-94 Page 1				
Plant name	Cooling Cooling Air-Coo Compute A/C Rec	led Chiller r-Generated iprocating						
AIR SYSTEM SELECTIONS								
Air System Name			Quantity					
7. AHU-1 PLC 8. AHU-2 PLC 9. AHU-3 PLC 10. AHU-4 PLC 11. AHU-5 PLC	NG CHILLER DATA	. (MZ) . (SZ CAV) . (MZ)	1 1 1 1					
Estimated maximum coor Chiller capacity at a Chiller input power a Chiller configuration Is chilled water results hot gas bypass use a load for minimum un Crankcase heater kW.	design: at design: n	NA 112.0 Tons 1.200 kW/To lt. Compress N N 20.0 %		Unloaded				
PUMP AND PIPING SYSTEM	PUMP AND PIPING SYSTEM DATA							
Pump or Piping System		Efficiencie Mech Ele	es Pump ec Power					
Chilled Water	10.0 54.00	80.0 89	.0 3.84	5.0				

Plant: Heating Plant - PLC Prepared By: EINHORN YAFFEE PRESCOTT ***********************************								
PLANT NAME,	CLASSIFICA	TION & TYPE						
Classific Type	cation	: Heati : Heati : Hot W	.ng					
AIR SYSTEM	SELECTIONS							
Air Sy	/stem Name			ating Coil Central				
7. AHU-1	PLC			1	-	1		
8. AHU-2	PLC			1	-	-		
9. AHU-3	PLC			1	-	1		
		. <i>.</i>		1	-	-		
				1	-	1		
12. AHU-6			•	1	_	1		
Gross out Energy ir Overall e Fuel or e	eput at design aput at design efficiency a energy type.	ating load:  gn:  gn:  t design:  r kW:	1339.0 1575.3 85.0	MBH MBH %				
BOILER PA	ART-LOAD PER	FORMANCE DATA		<b></b>				
% Load (	Overall Eff.	(%) % Load	Overall	Eff. (%)				
90	85.0	40	8	5.0		_		
80	85.0	30		5.0				
70	85.0	20		5.0				
60	85.0	10						
50	85.0	0		0.0 				
	IPING SYSTEM	DATA						
Pump or Piping Syst			mp Effic	iencies	Pump Power (kW)	Piping Gain/Loss (%)		
		20.0 48.0						

Plant: Cooling Plant - DDC Prepared By: EINHORN YAFFEE P		*****	******	12-30-94 Page 1
PLANT NAME, CLASSIFICATION &	TYPE			
Plant name	<pre>.: Cooling .: Air-Cool .: Computer .: A/C Reci</pre>	ed Chiller -Generated procating	2	
AIR SYSTEM SELECTIONS				
Air System Name		Туре	Quantity	
13. AHU-1 DDC		(MZ) (SZ CAV) (MZ)	1 1 1 1	
Estimated maximum cooling land Chiller capacity at design. Chiller input power at design. Chiller configuration Is chilled water reset used Is hot gas bypass used load for minimum unloading Crankcase heater kw	: gn: Mul??	NA 112.0 Tons 1.200 kW/To t. Compress Y N 20.0 %		Unloaded
PUMP AND PIPING SYSTEM DATA				
	Pump T Head ') (ft wg)		ec Power	Piping Gain/Loss (%)
Chilled Water 10.	0 54.00	80.0 89	.0 3.84	5.0

Prepared By	ting Plant - y: EINHORN Y *****	AFFEE PRI		*****	*****	*****	08-15-95 Page
	, CLASSIFICA		YPE				
Plant nar Classific	mecation		: Heatin	ıg			
	SELECTIONS						
	ystem Name			Hea	ting Coil	Categor	У
					<b></b>		
13. AHU-1					1	-	1
14. AHU-2	DDC				1	_	-
15. AHU-3 16. AHU-4	DDC				1	-	1
16. AHU-4					1	-	-
	DDC				1	-	1 1
ፈርጥ መአጥሮር ነ	BOILER DATA						
HOI WAIER I	SOILER DATA						
	d maximum he	-		1408.7 1339.0			
	nput at desi			1575.3			
	efficiency a			85.0	<b>ે</b>		
	energy type.			at. Gas			
Combustion	on air blowe	r kW	:	0.685	kW		
BOILER PA	ART-LOAD PER	FORMANCE	DATA				
% Load (	Overall Eff.	(%)	Load	Overall	Eff. (%)	·	
90	85.0		40	85	.0		
80	85.0		30	85			
70	85.0		20	85			
60	85.0		10	85			•
50	85.0		0	0			
	IPING SYSTEM						
			Pump	Effici	encies	Pump	Pipin
Pump or		Delta-T	Head	Mech	Elec	Power	Gain/Los
Piping Syst		(F)	(ft wg)	(웅)	(왕)	(kW)	(왕
Hot Water					89.0		5.

## BUILDING INPUT DATA

Empty 0.0 NA Empty 0.0 NA Empty 0.0 NA  MISCELLANEOUS FUEL USE  Reference Fuel Fuel Conversion Max. Name Type Units kBTU/Units Use Schedule Name	Prepared by:				****	****	. 4 4 4 4 4 4 4 4	01-06-95 Page I
PLANT SELECTION  Plant Name  Plant Name  Type  Quantity  1. Cooling Plant - Baseline	BUILDING NAM	E	: Bu	ilding 200 -	Baseli	ne		
Plant Name								
1. Cooling Plant - Baseline	PLANT SELECT	ION						
1. Cooling Plant - Baseline							.ty	
Max. Power Use	<ol> <li>Cooling</li> <li>Heating</li> </ol>	Plant -	Baseli Baseli	ne (A/ne (HW	C CHIL	LER) 1 R) 1		
Max. Power Use				R USE				
Empty 0.0 NA  Empty 0.0 NA  Empty 0.0 NA   MISCELLANEOUS FUEL USE  Reference Fuel Fuel Conversion Max. Name Type Units kBTU/Units Use Schedule Name  Empty NG THM 100.0000 0.0 NA  Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg  ELECTRIC RATE  Electric rate				Max. Powe				
Empty 0.0 NA  Empty 0.0 NA  MISCELLANEOUS FUEL USE  Reference Fuel Fuel Conversion Max. Name Type Units kBTU/Units Use Schedule Name  Empty NG THM 100.0000 0.0 NA  Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg  ELECTRIC RATE  Electric rate						Schedule	Name	
Empty 0.0 NA  Empty 0.0 NA  MISCELLANEOUS FUEL USE  Reference Fuel Fuel Conversion Max. Name Type Units kBTU/Units Use Schedule Name  Empty NG THM 100.0000 0.0 NA  Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg  ELECTRIC RATE  Electric rate	Empty					NA		
MISCELLANEOUS FUEL USE  Reference Fuel Fuel Conversion Max. Name Type Units kBTU/Units Use Schedule Name  Empty NG THM 100.0000 0.0 NA  Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg  ELECTRIC RATE  Electric rate								
MISCELLANEOUS FUEL USE  Reference Fuel Fuel Conversion Max. Name Type Units kBTU/Units Use Schedule Name  Empty NG THM 100.0000 0.0 NA  Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg  ELECTRIC RATE  Electric rate								
Reference Fuel Fuel Conversion Max. Name Type Units kBTU/Units Use Schedule Name  Empty NG THM 100.0000 0.0 NA  Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg  ELECTRIC RATE  Electric rate: Ft. Belvoir Equivalent \$/kWh Average building power factor: NA  FUEL RATES  Natural gas Washington Gas Rate Schedule 2  Fuel oil None Propane								
Reference Fuel Fuel Conversion Max.  Name Type Units kBTU/Units Use Schedule Name  Empty NG THM 100.0000 0.0 NA  Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg  ELECTRIC RATE  Electric rate: Ft. Belvoir Equivalent \$/kWh  Average building power factor.: NA  FUEL RATES  Natural gas Washington Gas Rate Schedule 2  Fuel oil None  Propane								
Empty NG THM 100.0000 0.0 NA  Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg  ELECTRIC RATE  Electric rate: Ft. Belvoir Equivalent \$/kWh Average building power factor: NA  FUEL RATES  Natural gas Washington Gas Rate Schedule 2 Fuel oil		Fuel	Fuel	Conversion	Max.			
Empty NG THM 100.0000 0.0 NA  Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg  ELECTRIC RATE  Electric rate: Ft. Belvoir Equivalent \$/kWh Average building power factor.: NA  FUEL RATES  Natural gas		Type	Units	kBTU/Units	Use	Schedule	Name	
Empty NG THM 100.0000 0.0 NA Empty NG THM 100.0000 0.0 NA  Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg  ELECTRIC RATE  Electric rate: Ft. Belvoir Equivalent \$/kWh Average building power factor: NA  FUEL RATES  Natural gas: Washington Gas Rate Schedule 2 Fuel oil	Empty	NG	THM	100.0000	0.0			
Empty NG THM 100.0000 0.0 NA  Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg  ELECTRIC RATE  Electric rate								
Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg  ELECTRIC RATE  Electric rate	-							
ELECTRIC RATE  Electric rate	Empty							
Electric rate: Ft. Belvoir Equivalent \$/kWh Average building power factor: NA  FUEL RATES  Natural gas: Washington Gas Rate Schedule 2 Fuel oil	Fuel Types:	NG=Nat.G	as FO=	Fuel Oil PR	Propan	e RH=Rmt	Htg	
Electric rate: Ft. Belvoir Equivalent \$/kWh Average building power factor: NA  FUEL RATES  Natural gas	ELECTRIC RAT	Ë						
Average building power factor: NA  FUEL RATES  Natural gas								
FUEL RATES  Natural gas: Washington Gas Rate Schedule 2 Fuel oil: None Propane: None Remote source heating: Ft. Belvoir District Steam Remote source cooling: None  MISCELLANEOUS DATA  Additional building floor area: 4854.0 sqft Source electric generating efficiency: 100.00 %	Average bui	lding po	wer fac	tor.: NA				
Natural gas: Washington Gas Rate Schedule 2 Fuel oil: None Propane: None Remote source heating: Ft. Belvoir District Steam Remote source cooling: None  MISCELLANEOUS DATA  Additional building floor area: 4854.0 sqft Source electric generating efficiency: 100.00 %								
Natural gas: Washington Gas Rate Schedule 2 Fuel oil: None Propane: None Remote source heating: Ft. Belvoir District Steam Remote source cooling: None  MISCELLANEOUS DATA  Additional building floor area: 4854.0 sqft Source electric generating efficiency: 100.00 %							<b></b>	
Propane: None Remote source heating: Ft. Belvoir District Steam Remote source cooling: None  MISCELLANEOUS DATA  Additional building floor area: 4854.0 sqft Source electric generating efficiency: 100.00 %								
Remote source heating: Ft. Belvoir District Steam Remote source cooling: None  MISCELLANEOUS DATA  Additional building floor area: 4854.0 sqft Source electric generating efficiency: 100.00 %								
MISCELLANEOUS DATA  Additional building floor area	Propane	 coe heati	nor.	: None	lvoir D	District St	team	
MISCELLANEOUS DATA  Additional building floor area								
Additional building floor area								
Additional building floor area	MISCELLANEOU	JS DATA						
Source electric generating efficiency 100.00 %	Additional	building	floor					
	Source elec	ctric ger	nerating	g efficiency.		:	100.00	용

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## BUILDING INPUT DATA

Prepared by: HAP v3.04			PRESCOTT	****	*****	*****	01-06-95 Page 1
		: Bu	ilding 200 -				
PLANT SELECT	ION 					<del></del> -	·
Plant Na					Quanti	ity	
3. Cooling	Plant -	PLC	/A)	C CHIL			
MISCELLANEOU	S ELECTRI	C POWE	R USE				
			Max. Powe	r Use			
Reference Nam				(kW)	Schedule	Name	<b></b>
Empty				0.0	NA		
Empty				0.0	NA		
Empty				0.0	NA NA		
	<b></b>	<b>-</b>					
MISCELLANEOU							
Reference			Conversion	Max.			<del>-</del>
Name	Type	Units	kBTU/Units		Schedule	Name	
Empty	NG	THM	100.0000		NA		
Empty		THM			NA		
Empty	NG NG	THM THM	100.0000 100.0000		NA NA		
	<b></b>						
Fuel Types:	NG=Nat.Ga 	ıs FO= 	Fuel Oil PR=	Propan	e RH=Rmt	Htg 	
ELECTRIC RAT	<b>-</b>						
Average bui	lding pow	ver fac	: Ft. Bel				
FUEL RATES							
			: Washing				2
Fuel oil			: None				
Propane			: None	voir I	District S	team	
Remote sour	ce coolir	ıq	: None				
MISCELLANEOU							
Additional Source elec	building tric gene	floor erating	area		:	100.00	も

--C-86

## BUILDING INPUT DATA

	****** E	****** : Bu	************ ilding 200 -		******	· * * * * * * * ·	01-06-95 Page 1
PLANT SELECT							
Plant Na					Quanti		
5. Cooling	Plant -	DDC	(A/				
MISCELLANEOU:	S ELECTR	IC POWE	R USE				
Reference Na			Max. Powe		Schedule	Name	
Empty Empty Empty				0.0 0.0 0.0 0.0	NA NA		
MISCELLANEOU							
Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max.	Schedule		
Empty Empty Empty	NG NG NG	THM THM THM THM	100.0000 100.0000 100.0000 100.0000	0.0 0.0 0.0	NA NA NA		
		as FO=	Fuel Oil PR=	Propan	e RH=Rmt	Htg	
ELECTRIC RAT  Electric ra Average bui  FUEL RATES	te lding po	wer fac					
Fuel oil Propane Remote sour Remote sour	ce heati	 .ng .ng	: None	voir I	District S	team	
MISCELLANEOU	S DATA						
Additional	building	floor	areag		:	4854.0	sqft %

**BUILDING 219** 

#### SIMULATION WEATHER DATA SUMMARY

Data: Washington, Dist. of Columbia (TMY) 12-30-94 HAP v3.04 Page 1 of 1

## TABLE 1. SIMULATION WEATHER DATA DESIGN PARAMETERS

City....: Washington

Location....: Dist. of Columbia
Type of Data....: Typical Meteorological Year

\* Average Ground Reflectivity..... 0.20

Local Time Zone (GMT +/- N hours)..... 5.0 hours

\* Daylight Savings Time Considered.....? N

\* = User-defined design parameters. All other values are fixed.

TABLE 2. DRY-BULB TEMPERATURE STATISTICS (F)

Month	Absolute Maximum	Average Maximum	Average	Average Minimum	Absolute Minimum	
January	60.4	39.3	30.7	21.0	-1.9	
February	62.1	42.8	33.1	22.9	7.5	
March	75.5	53.9	43.3	32.4	17.1	
April	85.5	65.7	55.0	44.3	31.2	
May	91.9	73.3	63.5	53.8	40.5	
June	93.5	80.8	70.0	58.8	48.8	
July	91.0	84.9	75.9	66.5	55.8	
August	96.8	85.1	74.3	64.5	49.6	
September	91.6	79.3	69.3	60.0	46.5	
October	84.7	67.5	56.8	46.7	23.4	
November	75. <i>7</i>	56.4	46.6	35.7	17.3	
December	59.0	42.7	36.9	30.9	20.5	

TABLE 3. DAILY TOTAL SOLAR RADIATION STATISTICS

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-----

		ly Total So (BTU/sqft)	olar]	[ Daily Clearness Number] (Dimensionless)			
Month	Maximum	Average	Minimum	Maximum	Average	Minimum	
January	1043.4	609.1	137.7	0.648	0.430	0.107	
February	1448.6	815.5	79.9	0.685	0.433	0.048	
March	1861.2	1183.4	211.6	0.680	0.473	0.094	
April	2371.0	1484.8	247.6	0.717	0.479	0.079	
May	2579.4	1712.0	355.4	0.711	0.487	0.104	
June	2551.8	1890.8	515.8	0.697	0.514	0.140	
July	2398.3	1714.6	629.5	0.657	0.478	0.171	
August	2378.9	1696.2	708.2	0.694	0.522	0.227	
September	1943.6	1307.6	258.0	0.674	0.482	0.094	
October	1546.1	977.2	92.6	0.656	0.469	0.045	
November	1143.4	672.4	129.4	0.647	0.437	0.094	
December	803.2	488.0	73.1	0.618	0.382	0.057	

Notes: \* All solar data is daily total flux on a horizontal surface.

<sup>\*</sup> Clearness number is (Daily Total Solar)/(Extraterrestrial Solar) Values between 0.70 and 0.80 represent clear conditions.

#### CALENDAR DATA

Prepared By: EINHORN YAFFEE PRESCOTT	12-30-94
HAP v3.04	Page 1 of 1
***********	<u> </u>
Calendar Name: Baseline	Day Type Assignments
	Monday = Weekday
January first is on: Saturday	Tuesday = Weekday
	Wednesday = Weekday
Day Type Names	Thursday = Weekday
Day Type 1 = Weekday	Friday = Weekday
Day Type 2 = Saturday	Saturday = Saturday
Day Type 3 = Sunday	Sunday = Sunday
	Holiday = Saturday
Holidays	
January 1 January 17 February 21	May 30 July 4
_	December 26

#### SCHEDULE DATA

SCHEDULE DATA												
_	Prepared By: EINHORN YAFFEE PRESCOTT 12-30-94											
HAP v3.04									. باد ماد ماد باد با	Page	1 0	
			****	****	****	****					****	****
Schedule Name	: Peo	рте 					HOU.	cly Pe	ercen	ages		
Hour>	00	01	02	03	04	05	06	07	08	09	10	11
			·									
DESIGN DAY	0	0	0	0	0	0	0	0	50	100	100	100
Weekday	0	0	0	0	0	0	0	0	10	25	40	50
Saturday	0	0	0	0	0	0	0	0	0	0	0	0
Sunday	0	0	0	0	0	0	0	0	0	0	10	25
Hour>	12	13	14	15	16	17	18	19	20	21	22	23
DESIGN DAY	100	<b>-</b> -	  100	100	100	1100	100	  100	100	75	50	0
Weekday	60	60	50	40	40	40	50	50	50	50	50	0
Saturday	10	50	50	50	50	50	50	50	50	50	50	0
Sunday	40	50	50	50	50	50	25	0	0	0	0	0
****	****	****	****	* * * * *	****	****	****	****	****	****	****	***
Schedule Name	: Lig	hts 					Hou	rly Pe	ercent	tages		
Hour>	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY	25	25	25	25	25	25	25	50	75	100	100	100
Weekday	25	25	25	25	25	25	25	50	75	100	100	100
Saturday	25	25	25	25	25	25	25	25	25	25	25	25
Sunday	25	25	25	25	25	25	25	25	25	25	25	25
Hour>	12	13	14	15	   16	17	18	19	20	21	22	23
	<u>-</u>		' 			<u>-</u>						
DESIGN DAY	100	100	100	100	100	50	25	25	25	25	25	25
Weekday	100	100	100	100	100	50	25	25	25	25	25	25
Saturday	25	25	25	25	25	25	25	25	25	25	25	25
Sunday	25	25	25	25	25	25	25	25	25	25	25	25
************ Schedule Name		***** ple A	***** udito:	***** rium	****	****	Hou:	rly P	***** ercen	***** tages	****	***
Hour>	00	01	02	03	04	05	06	07	08	09	10	11
DESTGN DAV	I 0	I 0	<del>-</del>	 I 0				   0	50	100	100	100
Weekday	1 0	0	1 0	0	0		0	0	10	25	25	25
Saturday	0		0	0	0	0	0	0	0	0	0	0
Sunday	0	0	0	0	0	0	0	0	0	0	10	25
	<u></u>				· 		<u>-</u>				· 	<u>-</u>
Hour>	12	13	14	15 	16	17	18	19 	20	21	22	23
DESIGN DAY	100	100	100	100	100	100	100	100	100	75	50	0
Weekday	25	25	25	25	25	25	25	25	25	50	50	50
Saturday	10	50	50	50	50	50	50	50	50	50	50	0
Sunday	40	50	50	50	50	50	25	0	0	0	0	0
********	****	****	****	****	****	****	****	****	****	****	****	****

#### SCHEDULE DATA

Prepared By: EINHORN YAFFEE PRESCOTT 12-30-94 HAP v3.04 Page 2 of 2												
Schedule Name								rly P				
Hour>	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY Weekday Saturday Sunday	15   15   15   15	15   15   15   15	15   15   15   15	15   15   15   15	15   15   15   15	15   15   15   15	15   15   15   15	15   15   15   15	50   10   15   15	100  100   15   15	100  100   15   15	100  100   15  100
Hour>	12	13	14	15	16	17	18	19	20	21	22	23
DESIGN DAY Weekday Saturday Sunday	100  100   15  100	100  100  100	100  100  100  100	100  100  100  100	100  100  100  100	100  100  100  100	100  100  100   25	100  100  100   15	100 100 100 15	75   50  100   15	50   50  100   15	15   50   15   15

## WALL CONSTRUCTION TYPES

Prepared by: EINHORN YAFFEE PRES HAP v3.04		*****	*****	I	2-30-94 Page 1
WALL TYPE 1: (CUSTOM WALL)					
Description: Brick Ca Absorptivity: 0.900	vity Wall				
Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance 1/2-in (13 mm) gypsum plaster 8-in (203 mm) LW concrete block 4-in (102 mm) face brick Outside surface resistance	8.00 4.00	45.0 38.0 125.0	0.20 0.22 -	2.02 0.43 0.33	41.7
Totals	12.50				68.9
Thickness: in Den R-value : (hr-sqft-F)/BTU Spe	sity: lb/cu cific Heat:		Weigh	it: lb/s	sqft

#### ROOF CONSTRUCTION TYPES

Prepared by: EINHORN YAFFEE :	PRESCOTT	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				2-30-94 Page 1
********	*****	*****	*****	*****	*****	*****
ROOF TYPE 1: (CUSTOM ROOF)						
Description: Shing Absorptivity 0.90	_					
Layer Description	Thickne	ss De	nsity	Spec.Ht	R-Val	Weight
Inside surface resistance	_	-	-	-	0.69	
3/4" Acoustic Ceiling Tile	0.			0.14		
1/2-in (13 mm) plywood	= :	50		0.29		1.4
Asphalt shingles	0.	13	70.0	0.30	0.43	0.7
Outside surface resistance		- 	-	-	0.33	-
Totals	1.	38			3.96	3.3
Thickness: in R-value : (hr-sqft-F)/BTU	Density: lb Specific He			_	nt: 1b/	sqft

## WINDOW TYPE CONSTRUCTIONS

Prepared by: EINHORN YAFFEE PRESCOTT 1	2-30-94
HAP v3.04	Page 1
****************	*****
WINDOW TYPE 1: (SIMPLE WINDOW)	
Window Description: Single Pane (By sqft)	
Height 1.00 ft	
Width 1.00 ft	
Overall U-value: 1.110 BTU/hr/sqft/F	
Overall Shade Coeff: 0.870	

Prepared by: EINHORN YAFFEE PRESCOTT		12-30-94
HAP v3.04		Page 1
************	*****	*****
GENERAL SCHEDULES		
Name: East Perimeter - 1st Flr Lighting: I	Lights	
Floor Area: 1550.0 sqft Task Lights.: I	Lights	
Building Weight.: 70.0 lb/sqft People: I	People	
Windows Shaded? N Equipment: I	People	
Partitions Used.? N Misc. Sens: I	-	
LIGHTING Misc. Latent: H	People	
Overhead Fixture: Recessed INFILTRATION		
Lamp Wattage: 3.00 W/sqft Cooling:		
Ballast Mult: 1.00 Heating:		
Task Lighting: 0.00 W/sqft Typical:	0.10 CF	M/sqft
PEOPLE When Fan On.?	Y	
Occupancy: 200.0 sqft/per FLOOR		
Activity Level: Office Work Type:Ak	pove Condition	oned Space
Sensible 245.0 BTU/hr		
Latent 205.0 BTU/hr		
OTHER LOADS		
Equipment: 1.50 W/sqft		
Misc. Sensible: 0.0 BTU/hr		
Misc. Latent: 0.0 BTU/hr		•
WIELE 02000 11200	INDOW	Any
Exp (sqft)   Type   Type Qty Shade   Type	Qty Shade	Doors?
E 1290.0   1   1 810 -   1	0 -	N
E 1290.0   1   1 810 -   1	-	1
ROOF Slope Gross Area   ROOF   SKYLIGHT		
Exp (deg) (sqft) Type Type Qty		
HOR - 984.0   1   1 0		
The state of the s		=======
No partition data for this space.		

Prepared by: EINHORN YAFFEE PRESCOTT	12-30-94					
HAP v3.04	Page 1					
*********	***********					
GENERAL	SCHEDULES					
Name: South Perimeter - 1st F	l Lighting: Lights					
Floor Area: 850.0 sqft	Task Lights.: Lights					
Building Weight.: 70.0 lb/sqft	People: People					
Windows Shaded? N	Equipment: People					
Partitions Used.? N	Misc. Sens: People					
LIGHTING	Misc. Latent: People					
Overhead Fixture: Recessed	INFILTRATION					
Lamp Wattage: 3.00 W/sqft	Cooling: 0.00 CFM/sqft					
Ballast Mult: 1.00	Heating: 0.00 CFM/sqft					
Task Lighting: 0.00 W/sqft	Typical: 0.10 CFM/sqft					
PEOPLE	When Fan On.? Y					
Occupancy: 200.0 sqft/pe	r FLOOR					
Activity Level: Office Work	Type:Above Conditioned Space					
Sensible 245.0 BTU/hr						
Latent 205.0 BTU/hr						
OTHER LOADS						
Equipment: 1.50 W/sqft						
Misc. Sensible: 0.0 BTU/hr						
Misc. Latent: 0.0 BTU/hr						
WALL Gross Area   WALL   WIN	DOW   WINDOW   Any					
Exp (sqft)   Type   Type Q	· · · · · · · · · · · · · · · · · ·					
Exp (sqlt)   Type   Type Q						
S 480.0   1   1 2	16 -   1 0 -   N					
N 430.0 1 1	0 -   1 0 -   N					
Value of an Jan data for this space						
No roof or door data for this space.						
No partition data for this space.						
-						

Prepared by: EINHORN YAFFEE PRESCOTT	12-30-94
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**************************************	CFM/sqft CFM/sqft CFM/sqft
Misc. Latent: 0.0 BTU/hr	:=========
WALL Gross Area   WALL   WINDOW   WINDOW Exp (sqft)   Type   Type Qty Shade   Type Qty Shad	Any de Doors?
W 1530.0   1   1 144 -   1 0 -	-   и
ROOF Slope Gross Area   ROOF   SKYLIGHT   Exp (deg) (sqft)   Type   Type Qty	
HOR - 664.0   1   1 0	
No partition data for this space.	

Prepared by: EINHORN YAFFEE PRES	COTT			12-30-94	
HAP v3.04				Page 1	
********	*****	*****	*****	*****	
GENERAL	SCHEDULES				
Name: North Perimeter - 1		: Lights	3		
Floor Area: 132.0 sqf		hts.: Lights			
Building Weight.: 70.0 lb/					
Windows Shaded? N		t: People			
Partitions Used.? N		ns: People			
LIGHTING		tent: People			
Overhead Fixture: Recessed	INFILTRAT	-			
Lamp Wattage: 3.00 W/s	qft Cooling.	:	0.00 CFM	1/saft	
		:		· -	
Task Lighting: 0.00 W/s	qft Typical.	:	).10 CFM	1/sqft	
PEOPLE	When Fan	On.?	Y	_	
Occupancy: 200.0 sqf	t/per FLOOR				
Activity Level: Office Work		:Above (	Conditio	oned Space	
Sensible: 245.0 BTU	/hr				
Latent 205.0 BTU	/hr				
OTHER LOADS					
Equipment: 1.50 W/s	qft				
Misc. Sensible: 0.0 BTU	/hr				
Misc. Latent: 0.0 BTU					
=======================================	=========				
WALL Gross Area   WALL		WINDOW		Any	
Exp (sqft) Type Type	e Qty Shade	Type Qty	Shade	Doors?	
N 110.0   1   1	0 -	1 0	-	N	
No roof or door data for this space.					
		=======			
No partition data for this space					
=======================================					

Prepared by: EINHORN YAFFEE PRESCOTT	12-30-94
HAP v3.04	Page 1
********	**********
GENERAL	SCHEDULES
Name: Interior - 1st Flr	Lighting: Lights
Floor Area: 10861.0 sqft	Task Lights.: Lights
Building Weight.: 70.0 lb/sqft	People: People
Windows Shaded? N	Equipment: People
Partitions Used.? N	Misc. Sens: People
LIGHTING	Misc. Latent: People
Overhead Fixture: Recessed	INFILTRATION
Lamp Wattage: 3.00 W/sqft	Cooling: 0.00 CFM/sqft
Ballast Mult: 1.00	Heating: 0.00 CFM/sqft
Task Lighting: 0.00 W/sqft	Typical: 0.00 CFM/sqft
PEOPLE	When Fan On.?
Occupancy: 200.0 sqft/per	FLOOR
Activity Level: Office Work	Type:Above Conditioned Space
Sensible 245.0 BTU/hr	
Latent 205.0 BTU/hr	
OTHER LOADS	
Equipment: 1.50 W/sqft	
Misc. Sensible: 0.0 BTU/hr	
Misc. Latent: 0.0 BTU/hr	
No external wall or window data for the	
ROOF Slope Gross Area   ROOF   SI	
Exp (deg) (sqft)   Type   Ty	
HOR - 2520.0   1	<u> </u>
nor - 2520.0   1	ı
No partition data for this space.	
<u>-</u>	

	SCRIPTION
Prepared by: EINHORN YAFFEE PRESCOTT	12-30-94
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*********	**********
GENERAL	SCHEDULES
Name: East Perimeter - 2nd Fla	Lighting: Lights
Floor Area: 1530.0 sqft	Task Lights.: Lights
Building Weight.: 70.0 lb/sqft	People: People
Windows Shaded? N	Equipment: People
Partitions Used.? N	Misc. Sens: People
LIGHTING	Misc. Latent: People
Overhead Fixture: Recessed	INFILTRATION
Lamp Wattage: 3.00 W/sqft	Cooling: 0.00 CFM/sqft
Ballast Mult: 1.00	Heating: 0.00 CFM/sqft
Task Lighting: 0.00 W/sqft	Typical: 0.10 CFM/sqft
PEOPLE	When Fan On.? Y
Occupancy: 200.0 sqft/per	FLOOR
Activity Level: Office Work	Type:Above Conditioned Space
Sensible: 245.0 BTU/hr	
Latent 205.0 BTU/hr	
OTHER LOADS	
Equipment: 1.50 W/sqft	
Misc. Sensible: 0.0 BTU/hr	
Misc. Latent: 0.0 BTU/hr	
WALL Gross Area   WALL   WINI	
Exp (sqft)   Type   Type Qt	ty Shade   Type Qty Shade   Doors?
E 1490.0   1   1 23	32 -   1 0 -   N
ROOF Slope Gross Area   ROOF   S	SKYLTGHT
Exp (deg) (sqft) Type Ty	
HOR - 1530.0   1	1 0
No partition data for this space.	

12-30-94				
SCHEDULES   Name				
Name         South         Perimeter         - 2nd Fl         Lighting         Lights           Floor Area         1200.0 sqft         Task Lights         Lights           Building Weight         70.0 lb/sqft         People         People           Windows Shaded         N         Equipment         People           Partitions Used         N         Misc         Sens         People           LIGHTING         Misc         Latent         People           Overhead Fixture         Recessed         INFILTRATION           Lamp Wattage         3.00 W/sqft         Cooling         0.00 CFM/sqft           Ballast Mult         1.00         Heating         0.00 CFM/sqft           Task Lighting         0.00 W/sqft         Typical         0.10 CFM/sqft           DEOPLE         When Fan On         Y           Occupancy         200.0 sqft/per         FLOOR           Activity Level         Office Work         Type         Type           Sensible         245.0 BTU/hr         Type         Above Conditioned Space           Equipment         1.50 W/sqft         Misc         Sensible           Misc         Sensible         0.0 BTU/hr           Misc         Latent <td< td=""></td<>				
Floor Area:				
Floor Area:				
## Building Weight: 70.0 lb/sqft				
Windows Shaded?         N         Equipment: People           Partitions Used.?         N         Misc. Sens: People           LIGHTING         Misc. Latent: People           Overhead Fixture: Recessed         INFILTRATION           Lamp Wattage:         3.00 W/sqft         Cooling:         0.00 CFM/sqft           Ballast Mult:         1.00         Heating:         0.00 CFM/sqft           Task Lighting:         0.00 W/sqft         Typical:         0.10 CFM/sqft           PEOPLE         When Fan On.?         Y           Occupancy:         200.0 sqft/per         FLOOR           Activity Level         Office Work         Type: Above Conditioned Space           Sensible:         245.0 BTU/hr           DTHER LOADS         Equipment:         1.50 W/sqft           Misc. Sensible         0.0 BTU/hr           Misc. Latent:         0.0 BTU/hr           Misc. Sensible         0.0 BTU/hr           Misc. Latent:         0.0 BTU/hr           Misc. Sensible				
Partitions Used.? N Misc. Sens.: People LIGHTING Misc. Latent: People Overhead Fixture: Recessed INFILTRATION  Lamp Wattage: 3.00 W/sqft Cooling: 0.00 CFM/sqft Ballast Mult: 1.00 Heating: 0.00 CFM/sqft Task Lighting: 0.00 W/sqft Typical: 0.10 CFM/sqft PEOPLE When Fan On.? Y Occupancy: 200.0 sqft/per FLOOR Activity Level.: Office Work Type:Above Conditioned Space Sensible: 245.0 BTU/hr Latent: 205.0 BTU/hr DTHER LOADS Equipment: 1.50 W/sqft Misc. Sensible.: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr WALL Gross Area WALL WINDOW WINDOW Any Exp (sqft) Type Type Qty Shade Type Qty Shade Doors?				
Overhead Fixture: Recessed INFILTRATION  Lamp Wattage: 3.00 W/sqft Cooling: 0.00 CFM/sqft Ballast Mult: 1.00 Heating: 0.00 CFM/sqft Task Lighting: 0.00 W/sqft Typical: 0.10 CFM/sqft PEOPLE When Fan On.? Y  Occupancy: 200.0 sqft/per FLOOR Activity Level.: Office Work Type:Above Conditioned Space Sensible: 245.0 BTU/hr Latent: 205.0 BTU/hr DTHER LOADS Equipment: 1.50 W/sqft Misc. Sensible.: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr  WALL Gross Area WALL WINDOW WINDOW Any Exp (sqft) Type Type Qty Shade Type Qty Shade Doors?				
Overhead Fixture: Recessed				
Ballast Mult:       1.00       Heating:       0.00 CFM/sqft         Task Lighting:       0.00 W/sqft       Typical:       0.10 CFM/sqft         PEOPLE       When Fan On.?       Y         Occupancy:       200.0 sqft/per FLOOR         Activity Level       Office Work       Type:Above Conditioned Space         Sensible:       245.0 BTU/hr         DTHER LOADS       Equipment:       1.50 W/sqft         Misc. Sensible:       0.0 BTU/hr         Misc. Latent:       0.0 BTU/hr         WALL Gross Area       WALL   WINDOW   WINDOW   Any         Exp       (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?         Exp       1120.0   1   1 288 -   1 0 -   N				
Ballast Mult:       1.00       Heating:       0.00 CFM/sqft         Task Lighting:       0.00 W/sqft       Typical:       0.10 CFM/sqft         PEOPLE       When Fan On.?       Y         Occupancy:       200.0 sqft/per FLOOR         Activity Level       Office Work       Type:Above Conditioned Space         Sensible:       245.0 BTU/hr         DTHER LOADS       Equipment:       1.50 W/sqft         Misc. Sensible:       0.0 BTU/hr         Misc. Latent:       0.0 BTU/hr         WALL Gross Area       WALL   WINDOW   WINDOW   Any         Exp       (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?         Exp       1120.0   1   1 288 -   1 0 -   N				
PEOPLE       When Fan On.?       Y         Occupancy:       200.0 sqft/per FLOOR         Activity Level:       Office Work       Type:Above Conditioned Space         Sensible:       245.0 BTU/hr         Latent:       205.0 BTU/hr         DTHER LOADS       Equipment:       1.50 W/sqft         Misc. Sensible:       0.0 BTU/hr         Misc. Latent:       0.0 BTU/hr         WALL Gross Area       WALL   WINDOW   WINDOW   Any         Exp       (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?         Es       1120.0   1   1 288 -   1 0 -   N				
PEOPLE       When Fan On.?       Y         Occupancy       200.0 sqft/per FLOOR         Activity Level       Office Work       Type:Above Conditioned Space         Sensible       245.0 BTU/hr         Latent       205.0 BTU/hr         DTHER LOADS       Equipment       1.50 W/sqft         Misc. Sensible       0.0 BTU/hr         Misc. Latent       0.0 BTU/hr         WALL Gross Area       WALL   WINDOW   WINDOW   Any         Exp       (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?         Es       1120.0   1   1 288 -   1 0 -   N				
Activity Level.: Office Work Type:Above Conditioned Space Sensible: 245.0 BTU/hr Latent: 205.0 BTU/hr DTHER LOADS Equipment: 1.50 W/sqft Misc. Sensible.: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr WALL Gross Area   WALL   WINDOW   WINDOW   Any Exp (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?				
Activity Level.: Office Work Type:Above Conditioned Space Sensible: 245.0 BTU/hr Latent: 205.0 BTU/hr DTHER LOADS Equipment: 1.50 W/sqft Misc. Sensible.: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr  WALL Gross Area   WALL   WINDOW   WINDOW   Any Exp (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?				
Sensible: 245.0 BTU/hr Latent: 205.0 BTU/hr DTHER LOADS  Equipment: 1.50 W/sqft  Misc. Sensible.: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr  WALL Gross Area   WALL   WINDOW   WINDOW   Any Exp (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?				
DTHER LOADS  Equipment: 1.50 W/sqft  Misc. Sensible: 0.0 BTU/hr  Misc. Latent: 0.0 BTU/hr  WALL Gross Area   WALL   WINDOW   WINDOW   Any  Exp (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?				
DTHER LOADS  Equipment: 1.50 W/sqft  Misc. Sensible: 0.0 BTU/hr  Misc. Latent: 0.0 BTU/hr  WALL Gross Area   WALL   WINDOW   WINDOW   Any  Exp (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?				
Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr  WALL Gross Area   WALL   WINDOW   WINDOW   Any Exp (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?				
Misc. Sensible: 0.0 BTU/hr Misc. Latent: 0.0 BTU/hr  WALL Gross Area   WALL   WINDOW   WINDOW   Any Exp (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?				
WALL Gross Area   WALL   WINDOW   WINDOW   Any Exp (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?  E 1120.0   1   1 288 -   1 0 -   N				
WALL Gross Area   WALL   WINDOW   WINDOW   Any Exp (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?  5 1120.0   1   1 288 -   1 0 -   N				
Exp (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?  1120.0   1   1 288 -   1 0 -   N				
3 1120.0   1   1 288 -   1 0 -   N				
ROOF Slope Gross Area   ROOF   SKYLIGHT				
Exp (deg) (sqft) Type Type Qty				
HOR - 1200.0   1   1 0				
The same of the few this space				
No partition data for this space.				

HAP v3.04  ***********************************				
GENERAL SCHEDULES  Name: West Perimeter - 2nd Flr Lighting: Lights  Floor Area: 1632.0 sqft Task Lights.: Lights  Building Weight: 70.0 lb/sqft People: People Windows Shaded? N Equipment: People				
Name: West Perimeter - 2nd Flr Lighting: Lights Floor Area: 1632.0 sqft Task Lights.: Lights Building Weight.: 70.0 lb/sqft People: People Windows Shaded? N Equipment: People				
Floor Area: 1632.0 sqft Task Lights: Lights Building Weight: 70.0 lb/sqft People: People Windows Shaded? N Equipment: People				
Building Weight.: 70.0 lb/sqft People: People Windows Shaded? N Equipment: People				
Windows Shaded? N Equipment: People				
Dantitions Hand 2 N Miss Cons - Dannie				
Partitions used.? N Misc. Sens.: People				
LIGHTING Misc. Latent: People				
Overhead Fixture: Recessed INFILTRATION				
Lamp Wattage: 3.00 W/sqft Cooling: 0.00 CFM/sqft				
Ballast Mult: 1.00 Heating: 0.00 CFM/sqft				
Task Lighting: 0.00 W/sqft Typical: 0.10 CFM/sqft				
PEOPLE When Fan On.? Y				
Occupancy: 200.0 sqft/per FLOOR				
Activity Level: Office Work Type:Above Conditioned Space				
Sensible: 245.0 BTU/hr				
Latent 205.0 BTU/hr				
OTHER LOADS				
Equipment: 1.50 W/sqft				
Misc. Sensible: 0.0 BTU/hr				
Misc. Latent: 0.0 BTU/hr				
WALL Gross Area   WALL   WINDOW   WINDOW   Any				
Exp (sqft)   Type   Type Qty Shade   Type Qty Shade   Doors?				
W 1600.0   1   1 162 -   1 0 -   N				
ROOF Slope Gross Area   ROOF   SKYLIGHT				
Exp (deg) (sqft)   Type   Type   Qty				
HOR - 1632.0   1   1 0				
No partition data for this space.				

Prepared by: EINHORN YAFFEE I	PRESCOTT	12-30-94
HAP v3.04		Page 1
*******	******	*********
GENERAL	SCHEDULES	3
Name: North Perimeter	- 2nd Fl Lighting	g: Lights
Floor Area: 792.0		
Building Weight.: 70.0	lb/sqft People	: People
Windows Shaded? N		nt: People
Partitions Used.? N	Misc. Se	ens: People
LIGHTING	Misc. La	atent: People
Overhead Fixture: Recessed	INFILTRAT	TION
Lamp Wattage: 3.00		: 0.00 CFM/sqft
Ballast Mult: 1.00		: 0.00 CFM/sqft
Task Lighting: 0.00	W/sqft Typical.	: 0.10 CFM/sqft
PEOPLE	When Far	on.? Y
Occupancy: 200.0	sqft/per FLOOR	
Activity Level: Office Wor		:Above Conditioned Space
Sensible: 245.0		
Latent 205.0	BTU/hr	
OTHER LOADS		
Equipment: 1.50	W/sqft	
Misc. Sensible: 0.0		
Misc. Latent: 0.0	BTU/hr	
	WINDOW	WINDOW Any
Exp (sqft)   Type	Type Qty Shade	Type Qty Shade   Doors?
N 800.0   1	1 0 -	1 0 - N
		I 0 -   N
ROOF Slope Gross Area		
Exp (deg) (sqft)		
Exp (deg) (sqrc)		
HOR - 792.0	1   1 0	
=======================================		' 
No partition data for this sp		
•	=	

Prepared by: EINHORN YAFFEE PRESC	COTT 12-30-94				
HAP v3.04	Page 1				
*******	*************				
GENERAL	SCHEDULES				
Name: Interior - 2nd Flr	Lighting: Lights				
Floor Area: 5040.0 sqft	Task Lights.: Lights				
Building Weight.: 70.0 lb/s	sqft People: People				
Windows Shaded? N	Equipment: People				
Partitions Used.? N	Misc. Sens: People				
LIGHTING	Misc. Latent: People				
Overhead Fixture: Recessed	INFILTRATION				
Lamp Wattage: 3.00 W/sc	qft Cooling: 0.00 CFM/sqft				
Ballast Mult: 1.00	Heating: 0.00 CFM/sqft				
Task Lighting: 0.00 W/so	qft Typical: 0.00 CFM/sqft				
PEOPLE	When Fan On.?				
Occupancy: 200.0 sqft					
Activity Level: Office Work	Type:Above Conditioned Space				
Sensible 245.0 BTU					
Latent 205.0 BTU,	/hr				
OTHER LOADS					
Equipment: 1.50 W/so					
Misc. Sensible: 0.0 BTU,					
Misc. Latent: 0.0 BTU,					
No external wall or window data					
ROOF Slope Gross Area ROOI					
Exp (deg) (sqft)   Type					
HOR - 5040.0					
mor - 5040.0	•				
No partition data for this space.					
-	· ====================================				

Prepared by: EINHORN HAP v3.04	YAFFEE I	PRESCO	ΓT					12-30-94 Page 1	
**************************************									
GENERAL			S	CHEDULES	5				
Name: Auditor	ium			Lighting	J :	Lights	s - Aud	litorium	
Floor Area:	8000.0	sqft		Task Lig	hts.:	Lights	s - Aud	litorium	
Building Weight.:	70.0	lb/sqi	Et	People	:	People	a Audit	orium	
Windows Shaded?	N	<del>-</del>		Equipment: People Auditorium					
Partitions Used.?	N			Misc. Se	ens:	People	a Audit	orium	
LIGHTING				Misc. La	tent:	People	a Audit	orium	
Overhead Fixture: R	ecessed		I	NFILTRAT	CION				
Lamp Wattage:	3.00	W/sqft		Cooling.				M/sqft	
Ballast Mult:	1.00			Heating.				M/sqft	
Task Lighting:	0.00	W/sqf1		Typical.		(	).10 CF	M/sqft	
PEOPLE				When Far	on.?		Y		
Occupancy:		sqft/1							
Activity Level: S				Type					
Sensible:		BTU/h:		Perimete				300.0 ft	
Latent:	120.0	BTU/h		Slab Floor Area: 8000.					
OTHER LOADS				Floor R-				2.40	
± ±	0.00			Insulation R-value: 0.00					
Misc. Sensible:		BTU/h:							
Misc. Latent:		BTU/h:	r						
		:===== :::	=====	,		INDOW		7m;	
WALL Gross Area	WALL	туре	INDOW		Type		Shade	Any   Doors?	
Exp (sqft)	Туре	TAbe	QCY 	Shade	TAbe	Qcy	Jiiaue	DOOLS:	
N 2460.0	1	1	0	_	1	0	_	N	
E 1300.0	1	1	0	-	1	0	-	N	
S 1230.0	1	1	0	-	1	0	_	N	
W 1300.0	1	1	0	-	1	0	-	N	
		=====		======	======			=======================================	
ROOF Slope Gross	Area	ROOF	SKY	LIGHT					
Exp (deg) (	sqft)	Type	Туре	. Qty					
HOR - 8	1000.0	1	1 	. 0 	 <b></b>				
No partition data fo	r this s	=== <b>==</b> pace.	_====	4=====					
No parcicion data re	/ <u></u>	pacc.							

Name: Fan Coil Units - Baseline	12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan	Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCO	
*********	**********
1. SYSTEM NAME AND TYPE	
Name Fan Coil Units	- Baseline
Type : TERMINAL UNITS	
Number of Zones.: 8	<b>_</b>
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Supply Air	55.0 F
Fan Cycled for Cooling?	N
	0.100
HEATING SYSTEM DATA	0.200
Fan Cycled for Heating?	N
OUTDOOR VENTILATION DATA	
Common Ventilation System Used?	N
SAFETY FACTORS	
Sensible Cooling Factor:	0 %
Latent Cooling Factor:	0 %
Heating Factor	0 %
OUTDOOR VENTILATION DATA	
Type of Control:	
Design Ventilation Airflow:	0.0 CFM/person
=======================================	=======================================
3. ZONE DATA	
J. ZONE DATA	
ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling(F):	75.0
Unoccupied Cooling(F):	85.0
Occupied Heating(F):	70.0
Unoccupied Heating(F):	55.0
	3.0
	Fan Coil
Fan Total Static(in.wg.):	0.25
Fan Efficiency(%):	54

Name: Fan Coil Units - Ba: Type: TERMINAL UNITS - 2 Prepared by: EINHORN YAFF: ***********************************	-Pipe Fan Coils	12-30-94 HAP v3.04 Page 2
4. SCHEDULE DATA	=======================================	
	0   0   0   0   0   0   0   0   0   0	
Weekday	X   X   X   X   X   X   X   X   X   X	X   X   X   X   X   X   X   X   X   X
Cooling Available During	Unoccupied Period ? Y	
MONTHLY SCHEDULES	JAN   FEB   MAR   APR   MAY   JUN   JUL   A	AUG   SEP   OCT   NOV   DEC

Name: Interior 219 - Baseline	EM INPOI DATA
	12-30-94 9 CNV
Type: CONSTANT VOLUME - Single Zon Prepared by: EINHORN YAFFEE PRESCO	
	TT Page 1
1. SYSTEM NAME AND TYPE	
I. SIGILM NAME AND THE	
Name Interior 219 -	Baseline
Type CONSTANT VOLUM	
Number of Zones.: 1	
	=======================================
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Is Central Cooling Used?	Y
Supply Air:	12930.0 CFM
Coil Bypass Factor:	0.100
Fan Cycled for Cooling?	N
Supply Air Reset:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used?	Y
Fan Cycled for Heating?	N
Supply Air Reset:	Not Used
OUTDOOR VENTILATION DATA	
• •	Constant Airflow Rate
Design Ventilation Airflow:	3230.0 CFM
Dampers Open During Unocc Per.:	N 2 %
Damper Leak Rate:	2 %
SUPPLY DUCT DATA  Duct Heat Gain	2 %
Duct Leakage Rate:	5 %
RETURN PLENUM DATA	<b>5</b> •
Is a Return Plenum Used?	N
SUPPLY FAN DATA	••
Fan Type:	Forward Curved
	Draw-Thru
Fan Total Static:	2.00 in.wg.
Fan Efficiency:	54 %
RETURN FAN DATA	
Fan Type:	User Defined
Fan Total Static:	0.25 in.wg.
Fan Efficiency:	50 %
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	None
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used?	N
HUMIDIFICATION	
Humidification System Used?	N
DEHUMIDIFICATION	М
Dehumidification System Used?	N
VENTILATION HEAT RECLAIM	None
Reclaim Unit Type: SAFETY FACTORS	1.0116
Sensible Cooling Factor:	0 %
Latent Cooling Factor	0 %
Heating Factor	0 %
=======================================	

Name: Interior 219 - Baseline Type: CONSTANT VOLUME - Single Zon Prepared by: EINHORN YAFFEE PRESCO	TT	12-30-94 HAP v3.04 Page 2
3. ZONE DATA		
ZONE T-Stat Occupied Cooling(F):	1 (All 75.0 85.0 70.0	Zones the Same)
Unoccupied Heating(F):	55.0	
Throttling Range(F):	3.0	
Zone Heating Unit Type:	None	
Trip Temperature(F):	-	
Design Supply Temperature(F):	-	
<pre>Fan Total Static(in.wg.): Fan Efficiency(%):</pre>	- -	
Zone Terminal Type:	Diffuser	
Reheat Coil?	N	
Direct Exhaust Airflow(CFM):	0.0	
Direct Exhaust Fan kW(kW):	0.0	
	=========	
4. SCHEDULE DATA		
	00000001111	1   1   1   1   1   1   1   2   2   2
		2 3 4 5 6 7 8 9 0 1 2 3
Design Day  X X X X X	X   X   X   X   X   X   X   X	x   x   x   x   x   x   x   x   x   x
Weekday   X X X X X		
Saturday         X   X   X   X   X   X   X   X   X   X		
		=======================================
Cooling Available During Unoccupie	ed Period ? Y	
		JUL   AUG   SEP   OCT   NOV   DEC
Central Heating   XXX   X		

Name: Auditorium - Baseline Type: CONSTANT VOLUME - Single Zone Prepared by: EINHORN YAFFEE PRESCOT	
1. SYSTEM NAME AND TYPE	
Name	
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	Y
Is Central Cooling Used?	30000.0 CFM
Supply Air	
Coil Bypass Factor	0.100 N
Fan Cycled for Cooling? Supply Air Reset HEATING SYSTEM DATA	Not Used
Is Central Heating Used?	Y
Fan Cycled for Heating?	N N
Supply Air Reset:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control:	Constant Airflow Rate
Design Ventilation Airflow:	5000.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain:	2 %
Duct Leakage Rate:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used?	N
SUPPLY FAN DATA	
Fan Type:	Forward Curved
Configuration:	Draw-Thru
Fan Total Static:	2.50 in.wg.
Fan Efficiency:	54 %
RETURN FAN DATA	
Fan Type:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	None
PREHEAT COIL	_
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used?	N
HUMIDIFICATION	
Humidification System Used?	N
DEHUMIDIFICATION	NT
Dehumidification System Used?	N
VENTILATION HEAT RECLAIM	None
Reclaim Unit Type:	None
SAFETY FACTORS	0 %
Sensible Cooling Factor:  Latent Cooling Factor:	0 %
Heating Factor:	0 %

Name: Auditorium - Basel:	·								1 7	20 0
		000 001							12- HAP	30 - 9
Type: CONSTANT VOLUME - S										
Prepared by: EINHORN YAFI	FEE PRES	COTT			++++			++++		ge ****
******	****	****	* * * * *	* * * * *						
3. ZONE DATA										
ZONE			 1	(All	Zon	es t	he	 Same	 )	
T-Stat Occupied Cooling.	(F):	7	5.0							
Unoccupied Cooling	_	8	5.0							
Occupied Heating.		7	0.0							
Unoccupied Heating			5.0							
Throttling Range.			3.0							
Zone Heating Unit Type		N	one							
Trip Temperature			-							
Design Supply Temperati			-							
Fan Total Static(in			-							
Fan Efficiency		Diffu	-							
Zone Terminal Type  Reheat Coil		DITIU	ser N							
Reneat Coll Direct Exhaust Airflow			0.0							
			0.0							
Direct Evhauet Fan kW	(kW) ·		0.0							
			0.0 =====	====	====	====			====	====
Direct Exhaust Fan kW			0.0 ====	====	====	===:	-==			===:
4. SCHEDULE DATA	======	======	0.0 ====	====	====	====	===	====	====	===:
4. SCHEDULE DATA		======	====	==== =====	====	==== ====	==== ====  1 1	====	====	:===: :===:
4. SCHEDULE DATA	=======================================	=======================================	=====							
4. SCHEDULE DATA	=======================================	======  0 0 0 0  4 5 6 7	=====							
4. SCHEDULE DATA  HOURLY TSTAT SCHEDULES	======  0 0 0 0  0 1 2 3	4   5   6   7	=====  0 0   8 9	0 1	2   3	4   5 	6   7	8 9 	0   1	.   2   3
4. SCHEDULE DATA  ==================================	======  0 0 0 0  0 1 2 3   X X X X	4 5 6 7   X X X X	=====  0 0   8 9	0   1     X   X	2   3    X   X	4   5  X   X	6   7    X   X	8 9   X X	0   1    X   X	. 2 3 
4. SCHEDULE DATA  HOURLY TSTAT SCHEDULES  Design Day	======  0 0 0 0  0 1 2 3   X X X X  X X X X	4 5 6 7    X X X X   X X X X	=====  0 0   8 9   X X   X X	0   1     X   X     X   X	2   3    X   X   X   X	4   5  X   X X   X	6   7     X   X   X   X	8   9     X   X   X   X	0   1    X   X	2 3    X 2  X 2
4. SCHEDULE DATA  ==================================	======  0 0 0 0  0 1 2 3   X X X X  X X X X	4 5 6 7 	0   0   0   8   9	0   1     X   X     X   X     X   X	2   3    X   X   X   X   X   X	4   5 X   X X   X X   X	6   7   X   X   X   X   X   X	8   9      X   X   X   X	0   1   X   X   X   X	2   3   X   2   X   2   X   2
4. SCHEDULE DATA  ==================================	=======  0 0 0 0 0  0 1 2 3   X X X X  X X X X  X X X X	4   5   6   7   X   X   X   X   X   X   X   X   X   X	0   0   8   9	0   1     X   X     X   X     X   X     X   X	2   3    X   X   X   X   X   X	4   5 X   X X   X X   X	6   7   X   X   X   X   X   X	8   9      X   X   X   X	0   1   X   X   X   X	2   3   X   2   X   2   X   2
4. SCHEDULE DATA  ==================================	=======  0 0 0 0  0 1 2 3   X X X X  X X X X  X X X X  X X X X	4 5 6 7   X X X X  X X X X  X X X X  X X X X	0   0   0     8   9	0   1     X   X     X   X     X   X     X   X	2   3	4   5  X   X X   X X   X X   X ====	6   7    X   X   X   X   X   X   X   X	8   9      X   X     X   X     X   X	0   1   X   X   X   X   X   X   X   X	2   3 
4. SCHEDULE DATA  HOURLY TSTAT SCHEDULES  Design Day	======================================	4 5 6 7   X X X X  X X X X  X X X X  X X X X	0   0   0     8   9	0   1     X   X     X   X     X   X     X   X	2   3    X   X   X   X   X   X   X   X	4   5  X   X X   X X   X X   X ===:	6   7    X   X   X   X   X   X	8   9       X   X   X   X   X   X   X   X	0   1     X   X     X   X     X   X	2   3   3   3   3   3   3   3   3   3
4. SCHEDULE DATA  HOURLY TSTAT SCHEDULES  Design Day	0   0   0   0   0   0   1   2   3   3   3   3   3   3   3   3   3	4 5 6 7 	0   0   0   8   9	0   1     X   X     X   X     X   X     X   X	2   3    X   X   X   X   X   X   X   X	4   5  X   X X   X X   X X   X ===:	6   7    X   X   X   X   X   X		0   1     X   X     X   X     X   X	2   3   3   3   3   3   3   3   3   3

Name: Fan Coil Units - PLC	12-30-94				
Type: TERMINAL UNITS - 2-Pipe Far	n Coils HAP v3.04				
Prepared by: EINHORN YAFFEE PRESCOTT Pag					
	**********				
1. SYSTEM NAME AND TYPE					
Name: Fan Coil Units Type: TERMINAL UNITS Number of Zones.: 8					
2. SYSTEM DESCRIPTION					
COOLING SYSTEM DATA					
Supply Air:	55.0 F				
Fan Cycled for Cooling?	N				
Coil Bypass Factor:	0.100				
HEATING SYSTEM DATA					
Fan Cycled for Heating?	N				
OUTDOOR VENTILATION DATA					
Common Ventilation System Used?	N				
SAFETY FACTORS					
Sensible Cooling Factor:	0 %				
Latent Cooling Factor:	0 % 0 %				
Heating Factor OUTDOOR VENTILATION DATA	0 %				
Type of Control	Constant Airflow Rate				
Design Ventilation Airflow:					
3	======================================				
3. ZONE DATA					
ZONE	1 (All Zones the Same)				
T-Stat Occupied Cooling(F):	75.0				
Unoccupied Cooling(F):	85.0				
Occupied Heating(F):	70.0				
Unoccupied Heating(F):	55.0				
Throttling Range(F):	3.0				
Zone Terminal Type:	Fan Coil				
Fan Total Static(in.wg.):	0.25				
Fan Efficiency(%):	54				

Type: TERMINAL UNITS - 2-Pipe Fan Coils
Prepared by: EINHORN YAFFEE PRESCOTT  4. SCHEDULE DATA  HOURLY TSTAT SCHEDULES   0   0   0   0   0   0   0   0   1   1
4. SCHEDULE DATA  HOURLY TSTAT SCHEDULES   0   0   0   0   0   0   0   0   0
HOURLY TSTAT SCHEDULES   0   0   0   0   0   0   0   0   0
HOURLY TSTAT SCHEDULES   0   0   0   0   0   0   0   0   0
O   1   2   3   4   5   6   7   8   9   0   1   2   3   4   5   6   7   8   9   0   1   2   3    Design Day
O   1   2   3   4   5   6   7   8   9   0   1   2   3   4   5   6   7   8   9   0   1   2   3    Design Day
Design Day
Weekday
Weekday
Saturday  Sunday  Sunday  Cooling Available During Unoccupied Period ? N
Saturday  Sunday  Sunday  Cooling Available During Unoccupied Period ? N
Cooling Available During Unoccupied Period ? N
Cooling Available During Unoccupied Period ? N
=======================================
=======================================
MONTHLY SCHEDULES   JAN   FEB   MAR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC
MONTHEL SCHEDOLES   OMATILES   MARCHER   CON   COL   MOV   BEC
Terminal Heating   XXX   XXX   XXX   XXX
Terminal Cooling

Name: Interior 219 - PLC Type: CONSTANT VOLUME - Single Zon Prepared by: EINHORN YAFFEE PRESCO	
1. SYSTEM NAME AND TYPE	
Name: Interior 219 - Type: CONSTANT VOLUM Number of Zones.: 1	PLC
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	Y
<pre>Is Central Cooling Used? Supply Air</pre>	
Coil Bypass Factor	0.100
Fan Cycled for Cooling?	N
Supply Air Reset HEATING SYSTEM DATA	Not Used
Is Central Heating Used?	Y
Fan Cycled for Heating?	N
Supply Air Reset OUTDOOR VENTILATION DATA	Not Used
Type of Control:	Constant Airflow Rate
Design Ventilation Airflow:	3230.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate:	2 %
SUPPLY DUCT DATA	0.0
Duct Heat Gain:	2 % 5 %
Duct Leakage Rate:	5 %
RETURN PLENUM DATA  Is a Return Plenum Used?	N
SUPPLY FAN DATA	Forward Curved
Fan Type:	
Configuration: Fan Total Static:	2.00 in.wg.
Fan Efficiency:	54 %
RETURN FAN DATA	
Fan Type:	User Defined
Fan Total Static:	0.25 in.wg.
Fan Efficiency:	50 %
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	None
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used? HUMIDIFICATION	N
Humidification System Used?	N
DEHUMIDIFICATION	
Dehumidification System Used? VENTILATION HEAT RECLAIM	N
Reclaim Unit Type:	None
SAFETY FACTORS	
Sensible Cooling Factor:	0 %
Latent Cooling Factor:	0 %
Heating Factor:	0 %

Name: Interior 219 - PLC	12-30-94		
Type: CONSTANT VOLUME - Single Zone CAV			
Type: CONSTANT VOLUME - Single Zone CAV HAP v3. Prepared by: EINHORN YAFFEE PRESCOTT Page			
*********	**********		
3. ZONE DATA			
ZONE	1 (All Zones the Same)		
T-Stat Occupied Cooling(F):	75.0		
Unoccupied Cooling(F):	85.0		
Occupied Heating(F):	70.0		
Unoccupied Heating(F):	55.0		
Throttling Range(F):	3.0		
Zone Heating Unit Type:	None		
Trip Temperature(F):	-		
Design Supply Temperature(F):	-		
Fan Total Static(in.wg.):	-		
Fan Efficiency(%):	-		
Zone Terminal Type:	Diffuser		
Reheat Coil?	N		
Direct Exhaust Airflow(CFM):	0.0		
Direct Exhaust Fan kW(kW):	0.0		
=======================================			
4. SCHEDULE DATA			
HOURLY TSTAT SCHEDULES  0 0 0 0			
	5678901234567890123		
[0]1/2 3 4			
Design Day			
Weekday			
Saturday			
Sunday			
	=======================================		
Cooling Available During Unoccupied Period ? N			
	AR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC		
Central Heating   XXX   XXX   XX   XXX   XX			

Name: Auditorium - PLC Type: CONSTANT VOLUME - Single Zone Prepared by: EINHORN YAFFEE PRESCON ************************************	Page 1 ************************************
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA  Is Central Cooling Used?  Supply Air	Y 30000.0 CFM 0.100 N Not Used
Is Central Heating Used? Fan Cycled for Heating? Supply Air Reset	Y N Not Used
Type of Control	Constant Airflow Rate 5000.0 CFM N 2 %
Duct Heat Gain	2 ° 5 %
SUPPLY FAN DATA  Fan Type: Configuration: Fan Total Static: Fan Efficiency:	Forward Curved Draw-Thru 0.90 in.wg. 54 %
RETURN FAN DATA Fan Type: OUTDOOR AIR ECONOMIZER	None
Outdoor Economizer Type:  PREHEAT COIL  Preheat Coil Used?	None N
PRECOOL COIL Precool Coil Used?	И
HUMIDIFICATION  Humidification System Used?  DEHUMIDIFICATION	N
Dehumidification System Used? VENTILATION HEAT RECLAIM Reclaim Unit Type	N None
SAFETY FACTORS  Sensible Cooling Factor: Latent Cooling Factor: Heating Factor:	0 % 0 % 0 %

Name: Auditorium - PLC	12-	30-94	
Type: CONSTANT VOLUME - Single Zone CAV			
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.0 Prepared by: EINHORN YAFFEE PRESCOTT Page			
*****		****	
3. ZONE DATA			
ZONE	1 (All Zones the Same)		
T-Stat Occupied Cooling(F):	75.0		
Unoccupied Cooling(F):	85.0		
Occupied Heating(F):	70.0		
Unoccupied Heating(F):	55.0		
Throttling Range(F):	3.0		
Zone Heating Unit Type:	None		
Trip Temperature(F):	-		
Design Supply Temperature(F):	-		
Fan Total Static(in.wg.):	-		
Fan Efficiency(%):	-		
	Diffuser		
Reheat Coil?	N		
Direct Exhaust Airflow(CFM):	0.0		
Direct Exhaust Fan kW(kW):	0.0		
=======================================	.======================================	=====	
4. SCHEDULE DATA			
TOTAL A MOMENT COMPANIES   0 0 0 0 0 0 0 0	0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 2 2	12121	
	5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1		
	5 6 7 6 9 0 1 2 3 4 5 0 7 0 9 0 1		
Design Day	x x x x x x x x x x x x x x	1   1	
Weekday		1 1 1	
Saturday		i i i	
Sunday		1 1 1	
=======================================		====	
Cooling Available During Unoccupied Period ? Y			
MONTHLY SCHEDULES   JAN   FEB   MA	R APR MAY JUN JUL AUG SEP OCT NOV	DEC	
Central Heating   XXX   XXX   XX	xxx	xxx	
Central Cooling		i i	

Name: Fan Coil Units - DDC  Type: TERMINAL UNITS - 2-Pipe Fan  Prepared by: EINHORN YAFFEE PRESCO	
1. SYSTEM NAME AND TYPE	
Name: Fan Coil Units Type TERMINAL UNITS Number of Zones.: 8	s - DDC
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Supply Air:	55.0 F
Fan Cycled for Cooling?	N
Coil Bypass Factor:	0.100
HEATING SYSTEM DATA	
Fan Cycled for Heating?	N
OUTDOOR VENTILATION DATA	N
Common Ventilation System Used? SAFETY FACTORS	N
Sensible Cooling Factor:	0 %
Latent Cooling Factor:	0 %
Heating Factor:	0 %
OUTDOOR VENTILATION DATA	
Type of Control:	
Design Ventilation Airflow:	0.0 CFM/person
3. ZONE DATA	
ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling(F):	75.0
Unoccupied Cooling(F):	85.0
Occupied Heating(F):	70.0
Unoccupied Heating(F):	55.0
Throttling Range(F):	3.0 Fan Coil
Zone Terminal Type:  Fan Total Static(in.wg.):	0.25
Fan Efficiency(%):	54
-	

Name: Fan Coil Units - DDC  Type: TERMINAL UNITS - 2-Pipe Fan Coils  Prepared by: EINHORN YAFFEE PRESCOTT  **********************************	12-30-94 HAP v3.04 Page 2		
4. SCHEDULE DATA	========		
HOURLY TSTAT SCHEDULES  0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1	1 2 2 2 2  9 0 1 2 3		
Design Day			
Cooling Available During Unoccupied Period ? N			
MONTHLY SCHEDULES   JAN   FEB   MAR   APR   MAY   JUN   JUL   AUG   SEP   OC	r nov dec		
Terminal Heating   XXX   XXX	XXX   XXX   		

Name: Interior 219 - DDC  Type: CONSTANT VOLUME - Single Zone Prepared by: EINHORN YAFFEE PRESCON	
1. SYSTEM NAME AND TYPE	
Name: Interior 219 - Type: CONSTANT VOLUM Number of Zones.: 1	DDC
2. SYSTEM DESCRIPTION	
COOLING SYSTEM DATA	
Is Central Cooling Used?	Y
	12930.0 CFM
Supply Air	0.100
Coil Bypass Factor:	N
Fan Cycled for Cooling? Supply Air Reset HEATING SYSTEM DATA	Not Used
Is Central Heating Used?	Y
Fan Cycled for Heating?	N N
Supply Air Reset: OUTDOOR VENTILATION DATA	Not Used
Type of Control:	Constant Airflow Rate
Design Ventilation Airflow:	3230.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain:	2 %
Duct Leakage Rate:	5 %
RETURN PLENUM DATA  Is a Return Plenum Used?	N
SUPPLY FAN DATA	<del>-</del>
Fan Type:	Forward Curved
Configuration:	
Fan Total Static:	2.00 in.wg.
Fan Efficiency:	54 %
RETURN FAN DATA	
Fan Type:	User Defined
Fan Total Static:	0.25 in.wg.
Fan Efficiency:	50 %
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type:	Integrated Enthalpy
OA Upper Cutoff Temp:	95.0 F
OA Lower Cutoff Temp:	0.0 F
PREHEAT COIL	
Preheat Coil Used?	N
PRECOOL COIL	
Precool Coil Used?	N
HUMIDIFICATION	
Humidification System Used?	N
DEHUMIDIFICATION	
Dehumidification System Used?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type:	None
Reduction of the Type of Type of the Type of the Type of Type of the Type of T	

Name: Interior 219 - DDC  Type: CONSTANT VOLUME - Single Zone CAV  Prepared by: EINHORN YAFFEE PRESCOTT  **********************************	12-30-94 HAP v3.04 Page 2			
2. SYSTEM DESCRIPTION (CONTINUED)				
SAFETY FACTORS Sensible Cooling Factor: Latent Cooling Factor: Heating Factor:	0 % 0 % 0 %			
3. ZONE DATA				
ZONE T-Stat Occupied Cooling(F): 75.0 Unoccupied Cooling(F): 85.0 Occupied Heating(F): 70.0 Unoccupied Heating(F): 55.0 Throttling Range(F): 3.0  Zone Heating Unit Type: None Trip Temperature(F): - Design Supply Temperature(F): - Fan Total Static(in.wg.): - Fan Efficiency(%): Zone Terminal Type: Diffuser Reheat Coil? N  Direct Exhaust Airflow(CFM): 0.0 Direct Exhaust Fan kW(kW): 0.0	(All Zones the Same)			
4. SCHEDULE DATA				
HOURLY TSTAT SCHEDULES  0 0 0 0 0 0 0 0 0	1 1 1 1 1 1 1 1 1 2 2 2 2   0 1 2 3 4 5 6 7 8 9 0 1 2 3			
	X   X   X   X   X   X   X   X   X			
Cooling Available During Unoccupied Period ? N				
	JUN   JUL   AUG   SEP   OCT   NOV   DEC			
Central Heating   XXX   XXX   XXX   XXX   Central Cooling           XXX				

Name: Auditorium - DDC	BM INFOI DAIR	12-30-94
Type: CONSTANT VOLUME - Single Zon	HAP v3.04	
Prepared by: EINHORN YAFFEE PRESCOTT Page		
*******		
1. SYSTEM NAME AND TYPE		
Name Auditorium - D		
Type CONSTANT VOLUM	E - Single Zo	one CAV
Number of Zones.: 1		
	=======================================	=======================================
2. SYSTEM DESCRIPTION		
COOLING SYSTEM DATA		
Is Central Cooling Used?	Y	
Supply Air:	30000.0	CFM
Coil Bypass Factor:	0.100	
Fan Cycled for Cooling?	N	
Supply Air Reset:	Not Used	
HEATING SYSTEM DATA		
Is Central Heating Used?	Y	
Fan Cycled for Heating?	Not Used	
Supply Air Reset OUTDOOR VENTILATION DATA	Not used	
Type of Control:	Constant A	irflow Rate
Design Ventilation Airflow:	5000.0	
Dampers Open During Unocc Per.:	N	
Damper Leak Rate:	2	<b>્</b>
SUPPLY DUCT DATA		
Duct Heat Gain:	2	용
Duct Leakage Rate:	5	१
RETURN PLENUM DATA		
Is a Return Plenum Used?	N	
SUPPLY FAN DATA	- 10	
Fan Type:	Forward Cu	rved
	Draw-Thru	in wa
Fan Total Static	54	in.wg.
RETURN FAN DATA	24	·
Fan Type:	None	
OUTDOOR AIR ECONOMIZER		
Outdoor Economizer Type:	Integrated	Dry-Bulb
OA Upper Cutoff Temp:	95.0	F
OA Lower Cutoff Temp:	0.0	F
PREHEAT COIL		
Preheat Coil Used?	N	
PRECOOL COIL	.,	
Precool Coil Used?	N	
HUMIDIFICATION	N	
Humidification System Used? DEHUMIDIFICATION	N	
Dehumidification System Used?	N	
VENTILATION HEAT RECLAIM	21	
Reclaim Unit Type:	None	
SAFETY FACTORS		
Sensible Cooling Factor:	0	१
Latent Cooling Factor:		90
Heating Factor:	_	8

Name: Auditorium - DDC	12-30-94		
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.0- Prepared by: EINHORN YAFFEE PRESCOTT Page			
<u> </u>	**********		
3. ZONE DATA			
ZONE	1 (All Zones the Same)		
T-Stat Occupied Cooling(F):	75.0		
Unoccupied Cooling(F):	85.0		
Occupied Heating(F):	70.0		
Unoccupied Heating(F):	55.0		
Throttling Range(F):	3.0		
Zone Heating Unit Type:	None		
Trip Temperature(F):	-		
Design Supply Temperature(F):	_		
Fan Total Static(in.wg.):	-		
Fan Efficiency(%):	-		
Zone Terminal Type:	Diffuser		
Reheat Coil?	N		
Direct Exhaust Airflow(CFM):	0.0		
Direct Exhaust Fan kW(kW):	0.0		
=======================================			
4. SCHEDULE DATA			
	0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 2 2 2 2		
	5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3		
Design Day			
Weekday			
Saturday			
Sunday			
Cooling Available During Unoccupied Period ? Y			
	AR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC		
Central Heating   XXX   XXX   XXX   Central Cooling	XX   XXX             XXX   XXX   XXX		

Name: Fan Coll Units - Ba Type: TERMINAL UNITS - 2 Prepared by: EINHORN YAFF ***********************************	-Pipe Fan Coil EE PRESCOTT		12-30-94 HAP v3.04 Page 1
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1	)		
1. East Perimeter - 1s	t Flr 1		
SPACES IN ZONE 2 (Zone 2	)		
2. South Perimeter - 1	st Fl 1		
SPACES IN ZONE 3 (Zone 3	)		
3. West Perimeter - 1s	t Flr 1		
SPACES IN ZONE 4 (Zone 4	)		
4. North Perimeter - 1	st Fl 1		
SPACES IN ZONE 5 (Zone 5	)		
6. East Perimeter - 2n	d Flr 1		
SPACES IN ZONE 6 (Zone 6	)		
7. South Perimeter - 2	nd Fl 1		
SPACES IN ZONE 7 (Zone 7	')		
8. West Perimeter - 2r	d Flr 1		
SPACES IN ZONE 8 (Zone 8			
9. North Perimeter - 2	and Fl 1		

Name: Interior 219 - Baseline	2		12-30-94
Type: CONSTANT VOLUME - Sing:	le Zone C	ZAV	HAP v3.04
Prepared by: EINHORN YAFFEE	PRESCOTT		Page 1
******		******	*****
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
=======================================			
SPACES IN ZONE 1 (Zone 1)			
5. Interior - 1st Flr		10. Interior - 2nd Fla	

Name: Auditorium - Baseline			12-30-94
Type: CONSTANT VOLUME - Sing	le Zone C	AV	HAP v3.04
Prepared by: EINHORN YAFFEE			Page 1
*****		*****	*****
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
=======================================			=======================================
SPACES IN ZONE 1 (Zone 1)			
11. Auditorium	1		

AIR Name: Fan Coil Units - PLC Type: TERMINAL UNITS - 2-Pipe Prepared by: EINHORN YAFFEE PR ************************************	RESCOTT		12-30-94 HAP v3.04 Page 1
1. SPACE SELECTION			
		Space Name	Qty
SPACES IN ZONE 1 (Zone 1)	:=======		========
1. East Perimeter - 1st Flr			
SPACES IN ZONE 2 (Zone 2)			
2. South Perimeter - 1st Fl			
SPACES IN ZONE 3 (Zone 3)	:===== <b>=</b>	***********	
3. West Perimeter - 1st Flr			
SPACES IN ZONE 4 (Zone 4)			
4. North Perimeter - 1st Fl	. 1		
SPACES IN ZONE 5 (Zone 5)	=========		
6. East Perimeter - 2nd Flr	1		
SPACES IN ZONE 6 (Zone 6)		=======================================	
7. South Perimeter - 2nd Fl			
SPACES IN ZONE 7 (Zone 7)		=======================================	
8. West Perimeter - 2nd Flr			
SPACES IN ZONE 8 (Zone 8)			=========
9. North Perimeter - 2nd Fl	1		

	R SYSTEM	INPUT DATA	
Name: Interior 219 - PLC			12-30-94
Type: CONSTANT VOLUME - Sing	le Zone	CAV	HAP v3.04
Prepared by: EINHORN YAFFEE	PRESCOTT		Page 1
*******	*****	*******	*****
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
5. Interior - 1st Flr	1	10. Interior - 2nd Flr	1

Name: Auditorium - PLC Type: CONSTANT VOLUME - Sing Prepared by: EINHORN YAFFEE	PRESCOTT		12-30-94 HAP v3.04 Page 1
1. SPACE SELECTION			~
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
11. Auditorium	1		

Name: Fan Coil Units - DDC	1		12-30-94
Type: TERMINAL UNITS - 2-Pip			HAP v3.04
Prepared by: EINHORN YAFFEE F		++++++++++	Page 1
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
1. East Perimeter - 1st Fl	lr 1		
SPACES IN ZONE 2 (Zone 2)			
2. South Perimeter - 1st F	Fl 1		
SPACES IN ZONE 3 (Zone 3)			
3. West Perimeter - 1st Fl	lr 1		
SPACES IN ZONE 4 (Zone 4)			
4. North Perimeter - 1st F			
SPACES IN ZONE 5 (Zone 5)			
6. East Perimeter - 2nd Fl			
SPACES IN ZONE 6 (Zone 6)			
7. South Perimeter - 2nd F	Fl 1		
SPACES IN ZONE 7 (Zone 7)			
8. West Perimeter - 2nd Fl	lr 1		
SPACES IN ZONE 8 (Zone 8)			
9. North Perimeter - 2nd B			=======================================

Name: Interior 219 - DDC			12-30-94
Type: CONSTANT VOLUME - Sing	le Zone	CAV	HAP v3.04
Prepared by: EINHORN YAFFEE	PRESCOTT		Page 1
******	*****	******	*****
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
=======================================	======		=======
SPACES IN ZONE 1 (Zone 1)			
	<del>-</del>		
5. Interior - 1st Flr	1	10. Interior - 2nd Flr	1

Name: Auditorium - DDC			12-30-94
Type: CONSTANT VOLUME - Sing	jle Zone C	AV	HAP v3.04
Prepared by: EINHORN YAFFEE	PRESCOTT		Page 1
*****	******	******	*****
1. SPACE SELECTION			
Space Name	Qty	Space Name	Qty
		=======================================	==========
SPACES IN ZONE 1 (Zone 1)			
11. Auditorium	1		

Plant: Cooling Plant ( Prepared By: EINHORN Y ************************************	AFFEE PRESC	Base COTT	******	****	****	12-30-94 Page 1
PLANT NAME, CLASSIFICA	TION & TYPE	3				
Plant name		Cooling Air-Coo Compute A/C Rec	led Chil r-Genera iprocat:	ller ated	s) - Base	
AIR SYSTEM SELECTIONS						
Air System Name				Q	uantity	
1. Fan Coil Units 2. Interior 219 -					1	
AIR-COOLED RECIPROCATI	NG CHILLER	DATA				
Estimated maximum co Chiller capacity at Chiller input power Chiller configuratio Is chilled water res Is hot gas bypass us % load for minimum u Crankcase heater kW.	design at design n et used ed nloading	: : Mu ? ?	NA 100.0 1.500 l 1. Comp N N 20.0	kW/Ton pressor %	s / Ckt.,	Unloaded
PUMP AND PIPING SYSTEM	DATA					
Pump or Piping System	Delta-T (F) (1	Head		Elec	Power	Piping Gain/Loss (%)
Chilled Water	11.2	70.00	70.0	80.0	5.04	0.0

Prepared By: EINHORN Y.	Plant: Heating Plant - Baseline Prepared By: EINHORN YAFFEE PRESCOTT ***********************************				
PLANT NAME, CLASSIFICA	TION & TYPE				
Plant name	Hea	ting Water Boil		e	
AIR SYSTEM SELECTIONS					
Air System Name		Heat			. Zone
1. Fan Coil Units - : 2. Interior 219 - Ba 3. Auditorium - Base	seline		1 1 1	<u>-</u> - -	- - -
HOT WATER BOILER DATA					
Estimated maximum he Gross output at desi- Energy input at desi- Overall efficiency a Fuel or energy type. Combustion air blowe	gn gn t design	: 2100.0 : 3500.0 : 60.0 : Nat. Gas	MBH MBH %		
BOILER PART-LOAD PER	FORMANCE DATA				
% Load Overall Eff.	(%) % Loa	d Overall	Eff. (%)		
90 60.0 80 60.0 70 60.0 60 60.0 50 60.0	3	0 60 0 60 0 60	0.0 0.0		
PUMP AND PIPING SYSTEM	DATA				
Pump or Piping System	Delta-T H (F) (ft		Elec	Power	
Hot Water		.00 70.0		4.94	0.0

Plant: Cooling (Audi	torium) - B	ase				12-30-94
Prepared By: EINHORN	YAFFEE PRE	SCOTT				Page 1
*****	******	*****	*****	*****	******	*****
DIANE MAME CIACCIET	CATTON C TV	ים חי				
PLANT NAME, CLASSIFI	CAIION & II				<b>-</b>	
Plant name	:	Cooling	(Audito	orium) -	Base	
Classification		-				
Туре						
Type of simulation						
Type of chiller			-			
AIR SYSTEM SELECTION						
n i Court ou . Mana		<b>-</b>				
Air System Name			туре	Qua	ancică	
3. Auditorium -						
				<b></b>	. <b></b>	
AIR-COOLED RECIPROCA Estimated maximum	cooling loa		NA			
Chiller capacity a	t design	:	40.0	<b>Tons</b>		
Chiller input powe	r at design	1:	1.250	kW/Ton		
Chiller configurat				pressors	/ Ckt.,	Unloaded
Is chilled water r Is hot gas bypass			N N			
% load for minimum			20.0	કુ.		
Crankcase heater k			0.000			
PUMP AND PIPING SYST						
			Effici	encies	Pump	Piping
Pump or	Delta-T					
Piping System	(F)	(ft wg)	(왕)	(%)	(kW)	(왕)
Chilled Water	12.4	70.00	70.0	80.0	1.82	0.0

Plant: Cooling Plant (Offices) - PLC Prepared By: EINHORN YAFFEE PRESCOTT ***********************************	12-30-94 Page 1
PLANT NAME, CLASSIFICATION & TYPE	
Plant name: Cooling Plant (Of Classification: Cooling Type: Air-Cooled Chille Type of simulation model: Computer-Generate Type of chiller: A/C Reciprocating	er ed
AIR SYSTEM SELECTIONS	
	Quantity
4. Fan Coil Units - PLC	
AIR-COOLED RECIPROCATING CHILLER DATA	
Estimated maximum cooling load: NA Chiller capacity at design: 100.0 Ton Chiller input power at design: 1.500 kW/ Chiller configuration Mult. Compre Is chilled water reset used? N Is hot gas bypass used? N % load for minimum unloading: 20.0 % Crankcase heater kW	Ton
PUMP AND PIPING SYSTEM DATA	
Pump Efficience Pump or Delta-T Head Mech E Piping System (F) (ft wg) (%)	cies Pump Piping Elec Power Gain/Loss (%) (kW) (%)
Chilled Water 11.2 70.00 70.0 8	30.0 5.04 0.0

	RN YAFFEE PRESCO	TT			12-30-94 Page 1
*****	****		*****	*****	
PLANT NAME, CLASSI	FICATION & TYPE				
Plant name Classification Type	He	ating			
Type					
AIR SYSTEM SELECTI	ons				
Air System Na	me	Pre-Heat	ating Coil Central	Terminal	. Zone
4. Fan Coil Unit	s - PLC		1	-	-
5. Interior 219 6. Auditorium -			1 1	-	-
Overall efficien Fuel or energy t		.: Nat. Gas			
	DEDECRMANCE DATE				
BOILER PART-LOAD		A	  Eff. (%)		
	Eff. (%) % Lc	TA oad Overall	Eff. (%)		
BOILER PART-LOAD % Load Overall 90 60 80 60	Eff. (%) % Lc	pad Overall 40 6	0.0 0.0		
BOILER PART-LOAD % Load Overall 90 60	Eff. (%) % Lc	Pad Overall 40 6 30 6 20 6	0.0 0.0		
BOILER PART-LOAD % Load Overall 90 60 80 60 70 60	Eff. (%) % Lc	Pad Overall 40 6 30 6 20 6 10 6	0.0 0.0 0.0		
BOILER PART-LOAD % Load Overall 90 60 80 60 70 60 60 60	Eff. (%) % Lo	Pad Overall 40 6 30 6 20 6 10 6	0.0 0.0 0.0 0.0		
BOILER PART-LOAD % Load Overall 90 60 80 60 70 60 60 60 50 60	Eff. (%) % Lo	Pad Overall 40 6 30 6 20 6 10 6	0.0 0.0 0.0 0.0 0.0	Pump	Piping
BOILER PART-LOAD % Load Overall 90 60 80 60 70 60 60 60 50 60	Eff. (%) % Lo .0 .0 .0 .0 .0 .0 .0 .D	TA  oad Overall  40 6 30 6 20 6 10 6	0.0 0.0 0.0 0.0 0.0 0.0		

Plant: Cooling (Auditor Prepared By: EINHORN YA	FFEE PRESCOTT				12-30-94 Page 1
******	*****	******	*****	*****	*****
PLANT NAME, CLASSIFICAT	CION & TYPE				
Plant name	: Cooli : Air-C del: Compu : A/C R	ng ooled Chill ter-Generat	er ed	PLC	
AIR SYSTEM SELECTIONS					
Air System Name		Type	Quar	-	
6. Auditorium - PLC		(SZ CA	V)	1	
AIR-COOLED RECIPROCATING Estimated maximum coo	oling load:	 NA			
Chiller capacity at d	lesign:	40.0 To	ns		
Chiller input power a	ıt design:	1.250 kW	/Ton	/ Cl-+	IIn] onded
Chiller configuration Is chilled water rese		Muic. Compi N	essors ,	/ CRL.,	Unitoaded
Is hot gas bypass use	ed?	N			
<pre>% load for minimum ur Crankcase heater kW</pre>		20.0 % 0.000 kW	•		
Crankcase neater kw					
PUMP AND PIPING SYSTEM	DATA				
		p Efficien			
	Delta-T Hea (F) (ft wg				
Chilled Water	12.4 70.0				

Plant: Cooling Plant ( Prepared By: EINHORN Y	AFFEE PRESCO	TT	*****	*****	*****	12-30-94 Page 1 ******
PLANT NAME, CLASSIFICA	TION & TYPE					
Plant name Classification Type Type of simulation m Type of chiller	: Co Ai odel: Co	oling r-Cool mputer C Reci	ed Chil -Genera procati	ller ated	) - DDC	
AIR SYSTEM SELECTIONS						
Air System Name			Туре	Qu		
7. Fan Coil Units 8. Interior 219 -	- DDC		(2P-E	FC)		
AIR-COOLED RECIPROCATI	NG CHILLER D	ATA				
Estimated maximum concluded Chiller capacity at Chiller input power Chiller configuration Is chilled water results hot gas bypass us load for minimum Crankcase heater kW.	design at design n et used ed nloading	.: .: Mul .? .?	1.500 }	<w ton<br="">pressors</w>	/ Ckt.,	Unloaded
PUMP AND PIPING SYSTEM	I DATA					
Pump or Piping System	Delta-T (F) (ft	Head	Mech	Elec	Power	
Chilled Water	11.2 7	0.00	70.0	80.0	5.04	0.0

Plant: Heating Plant - Prepared By: EINHORN Y.	AFFEE PRESCOTT	****	*****	*****	12-30-94 Page 1
PLANT NAME, CLASSIFICA					
Plant name	Heati	ng ater Boil			
AIR SYSTEM SELECTIONS					
Air System Name		Heat	ating Coil Central	Terminal	
7. Fan Coil Units - 1 8. Interior 219 - DDC 9. Auditorium - DDC.	DDC	  	1	-	- - -
HOT WATER BOILER DATA			·		
Estimated maximum her Gross output at design Energy input at design Overall efficiency a Fuel or energy type. Combustion air blower	gn: gn: t design:	2100.0 3500.0 60.0	MBH MBH %		
BOILER PART-LOAD PER	FORMANCE DATA		,		
% Load Overall Eff.	(%) % Load	Overall			
90 60.0 80 60.0 70 60.0 60 60.0 50 60.0	40 30 20 10	6	0.0 0.0 0.0		
PUMP AND PIPING SYSTEM	DATA				
Pump or Piping System	Pum Delta-T Hea (F) (ft wg	d Mech			
Hot Water	20.0 70.0			4.94	0.0

Plant: Cooling (Auditoriu Prepared By: EINHORN YAFF	EE PRESCOTT	*****	*****	12-30-94 Page 1 ******
PLANT NAME, CLASSIFICATIO	N & TYPE			
Plant name	: Cooling: Air-Coo l: Compute: A/C Rec	led Chiller r-Generated iprocating	- DDC	
AIR SYSTEM SELECTIONS				
Air System Name				<del></del>
9. Auditorium - DDC		. (SZ CAV)	1	
AIR-COOLED RECIPROCATING				
Estimated maximum cooli Chiller capacity at des Chiller input power at Chiller configuration Is chilled water reset Is hot gas bypass used. % load for minimum unlo Crankcase heater kW	ign: design:	NA 40.0 Tons 1.250 kW/Ton		
PUMP AND PIPING SYSTEM DA				
Pump or De			Power	Gain/Loss
Chilled Water	12.4 70.00	70.0 80.0	1.82	0.0

Prepared by: EIN HAP v3.04 **************** BUILDING NAME	*****	******		Pa:	
*****				******	
BUILDING NAME	В 	uilding 219 -	Raceli		****
			Dabell	.ne	
PLANT SELECTION					
Plant Name			Туре	Quantity	
<ol> <li>Cooling Plan</li> </ol>					
2. Heating Pla					
3. Cooling (Au	ıditorium)	- Base (A/	C CHIL	LER) 1	
MISCELLANEOUS EI	LECTRIC POW	ER USE			
		Max. Powe	r Hee		
Reference Name		Max. POWe	(kW)	Schedule Name	
Reference Name	<b></b>			Name	<del></del>
Empty			0.0	NA	
Empty			0.0	NA	
Empty			0.0	NA	
Empty			0.0	NA	
	Fuel Fuel Type Units			Schedule Name	
Empty	NG THM	100.0000	0.0	NA	
Empty	NG THM	100.0000	0.0	NA	
Empty	NG THM			NA	
Empty	NG THM	100.0000	0.0	NA	
Fuel Types: NG=N	Nat.Gas FO	=Fuel Oil PR=	Propar	ne RH=Rmt Htg	
ELECTRIC RATE					
Electric rate			woir E	Equivalent \$/kWh	
Average buildir			.VOII E	equivalenc \$/ kwn	
Average building	.19 power ra				
FUEL RATES					
					,
Natural gas Fuel oil Propane Remote source h		: None	rton Ga	as Rate Schedule 2	
Remote source	cooling	: None			

Prepared by: EINHORN YAFFEE PRESCOTT	12-30-94
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*************	******
MISCELLANEOUS DATA	
Additional building floor area	- <del>-</del> -

	EINHORN YAFF		JT DATA		12-30-9
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				******	*****
BUILDING NAM	E:	Building 219 -	PLC		
		·			
PLANT SELECT	ION				
Plant N	ame		 Туре	Quantity	
4 0 1		\ DT G / 7			
		ces) - PLC (A/ (HW			
_		- PLC (A/			
MISCELLANEOU:	S ELECTRIC PO	)WER USE 			
D 6		Max. Powe	er Use (kW)	Schedule Name	
Reference Na	me 	. <b></b>	(KW)	Name	
Empty			0.0	NA	
Empty			0.0	NA	
Empty			0.0	NA	
Empty			0.0	NA	
Reference Name	Fuel Fue Type Unit	el Conversion cs kBTU/Units	Max. Use	Schedule Name	
Empty		100.0000		NA	
Empty		100.0000		NA	
Empty	NG THM		0.0	NA NA	
Empty	NG THM	100.0000	0.0	NA	
Fuel Types:	NG=Nat.Gas I	FO=Fuel Oil PR=	Propan	e RH=Rmt Htg	
Fuel Types:		FO=Fuel Oil PR=	Propan	e RH=Rmt Htg	
ELECTRIC RAT	E				
ELECTRIC RAT	E	: Ft. Bel		e RH=Rmt Htg	
ELECTRIC RAT Electric ra Average bui	E	: Ft. Bel	 Lvoir E		
ELECTRIC RAT Electric ra Average bui	telding power i	: Ft. Bel	 Lvoir E	 quivalent \$/kWh	
ELECTRIC RAT Electric ra Average bui	telding power i	: Ft. Bel	lvoir E	quivalent \$/kWh	
ELECTRIC RAT Electric ra Average bui	telding power i	: Ft. Bel	lvoir E	quivalent \$/kWh	
ELECTRIC RAT  Electric ra Average bui  FUEL RATES  Natural gas	telding power i	: Ft. Bel	lvoir E	quivalent \$/kWh	
ELECTRIC RAT Electric ra Average bui FUEL RATES Natural gas Fuel oil	telding power	: Ft. Belfactor.: NA	lvoir E	quivalent \$/kWh	
ELECTRIC RAT Electric ra Average bui FUEL RATES Natural gas Fuel oil Propane	telding power	: Ft. Belfactor: NA: Washing: None: None	lvoir E	quivalent \$/kWh	· <del>-</del>
ELECTRIC RAT Electric ra Average bui FUEL RATES Natural gas Fuel oil Propane	telding power	: Ft. Belfactor.: NA	lvoir E	quivalent \$/kWh	

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MISCELLANEOUS DATA	
Additional building floor area	•

_ , ,		BOILDING INFO	+ DAIL	•	
Prepared by:	EINHORN YAFFE	EE PRESCOTT			12 <b>-</b> 30-94
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		*****		*****	*****
BUILDING NAM	E F	Building 219 - :	DDC		
PLANT SELECT					
Plant N			Type	Quantity	
		es) - DDC (A/			
_		(HW			
_		- DDC (A/		LER) I	
	a ereampta por	TED HOT			
MISCELLANEOU	S ELECTRIC POV	VER USE			
		Max. Powe	r Hee		
Reference Na	mo.	Max. Fowe	(kW)	Schedule Name	
	c		(24)	Schedule Name	· 
Empty			0.0	NA	
Empty			0.0	NA	
Empty			0.0	NA	
Empty			0.0	NA	
Lupey					
	Fuel Fuel	l Conversion s kBTU/Units	Max.	Schedule Name	<u> </u>
Empty	NG THM				
Empty	NG THM		0.0	NA	
Empty	NG THM				
	NG THM NG THM				
Empty	NG THM	100.0000	0.0	NA	
Empty	NG THM		0.0	NA	
Empty	NG THM	100.0000	0.0	NA	
	NG THM  NG=Nat.Gas F	100.0000	0.0	NA	
Empty  Fuel Types:  ELECTRIC RAT	NG THM  NG=Nat.Gas F	100.0000 D=Fuel Oil PR=	0.0  Propar	NA Le RH=Rmt Htg	
Empty  Fuel Types:   ELECTRIC RAT	NG THM  NG=Nat.Gas F	100.0000 D=Fuel Oil PR=	0.0 Propar	NA Le RH=Rmt Htg	
Empty  Fuel Types:  ELECTRIC RAT  Electric ra	NG THM  NG=Nat.Gas F(	100.0000 D=Fuel Oil PR=	0.0 Propar	NA Le RH=Rmt Htg	
Empty  Fuel Types:  ELECTRIC RAT  Electric ra  Average bui	NG THM  NG=Nat.Gas FG  TE  te	100.0000 D=Fuel Oil PR=	0.0 Propar	NA le RH=Rmt Htg	Ih
Empty  Fuel Types:  ELECTRIC RAT  Electric ra  Average bui	NG THM  NG=Nat.Gas FG  TE  te	100.0000 D=Fuel Oil PR=	0.0 Propar	NA le RH=Rmt Htg	Ih
Empty  Fuel Types:  ELECTRIC RAT  Electric ra  Average bui	NG THM  NG=Nat.Gas FG  TE  te	100.0000 D=Fuel Oil PR=	0.0 Propar	NA le RH=Rmt Htg	Ih
Empty  Fuel Types:  ELECTRIC RAT  Electric ra  Average bui  FUEL RATES	NG THM  NG=Nat.Gas FO  E  te	100.0000 D=Fuel Oil PR=	0.0 Propar  voir E	NA le RH=Rmt Htg  Gquivalent \$/kv	Ih
Empty  Fuel Types:  ELECTRIC RAT  Electric ra  Average bui  FUEL RATES	NG THM  NG=Nat.Gas FG  E  te	100.0000 D=Fuel Oil PR=	0.0 Propar	NA le RH=Rmt Htg 	Th
Empty  Fuel Types:  ELECTRIC RAT  Electric ra  Average bui  FUEL RATES  Natural gas	NG THM  NG=Nat.Gas FG  E  te	100.0000 D=Fuel Oil PR=: Ft. Bel actor: NA	0.0 Propar	NA le RH=Rmt Htg 	Th
Empty  Fuel Types:  ELECTRIC RAT  Electric ra  Average bui  FUEL RATES  Natural gas  Fuel oil	NG THM  NG=Nat.Gas FG  TE  Ate	100.0000 D=Fuel Oil PR=: Ft. Bel actor: NA: Washing: None	0.0 Propar	NA le RH=Rmt Htg 	Jh
Empty  Fuel Types:  ELECTRIC RAT  Electric ra  Average bui  FUEL RATES  Natural gas  Fuel oil  Propane	NG THM  NG=Nat.Gas FG  E  Ite	100.0000 D=Fuel Oil PR=: Ft. Bel actor: NA: Washing: None: None	0.0 Propar	NA le RH=Rmt Htg 	Jh
Empty  Fuel Types:  ELECTRIC RAT  Electric ra Average bui  FUEL RATES  Natural gas Fuel oil Propane Remote sour	NG THM  NG=Nat.Gas FG  TE  Ate	100.0000 D=Fuel Oil PR=: Ft. Bel actor: NA: Washing: None: None	0.0 Propar	NA le RH=Rmt Htg 	Jh

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MISCELLANEOUS DATA	
Additional building floor area	